

ABSTRACT

Title of Thesis: MEMORIZING THE SACRED IN THE
DIGITAL AGE: EXPLORING QUR'AN
MEMORIZATION EXPERIENCES USING
PHYSICAL & DIGITAL FORMATS

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For centuries, millions of Muslims have been memorizing the entirety of the Qur'an, the holy scripture of Islam that provides guidance to its believers and contains over seventy-seven thousand words in Arabic. This study explores the present-day experiences of these adherents who utilize traditional and digital methods to commit the Qur'an to memory and investigates whether the experience changes when using the different formats. The research instruments include multiple questionnaires, a monthlong diary study involving two weeks of memorization with a digital device and two weeks with a physical Qur'an and interviews with twenty-three participants. The study offers findings that include reported differences in difficulty, sentiments, and sense of connection to God, insights into the prevalent benefits and challenges of digital and traditional scriptural memorization and design suggestions on tools and methods to improve the experience of memorizing the Qur'an with both formats.

MEMORIZING THE SACRED IN THE DIGITAL AGE:
EXPLORING QUR'AN MEMORIZATION EXPERIENCES
USING PHYSICAL & DIGITAL FORMATS

by

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Dedication

In the name of Allah, the Exceptionally Merciful, the Perpetually Merciful.

To all Muslims memorizing the Qur'an around the world reading, reflecting, and repeating the words of God in the stillness of night, in the hum of Qur'an circles, and in the bustle of daily life. God sees what you do.

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Chapter 1: Introduction

1.1. Background and Motivation

The memorization of the Qur'an is a unique phenomenon in that the Qur'an "is perhaps the only book, religious or secular, that has been memorized completely by millions of people" [31] and is recited regularly from memory by over 1.6 billion adherents of the Islamic faith [71] to use in daily prayers, for spiritual guidance and teaching purposes, and to preserve the oral tradition [21]. The utilization of digital techniques to memorize the Qur'an adds a layer of uniqueness since it offers an opportunity to study the effects of memorizing large amounts of information in a digital format, particularly one that is spiritual in form and practice and written in a classical language not understood by many of its memorizers [67]. It can contribute to the foundational work of documenting the relationship of reading comprehension and recall on modes of reading and memorizing [57].

In the Muslim community, the usage of digital technology for Qur'an recitation and memorization is significant because it can allow specific groups such as adherents who have not completed purification rituals and women who are menstruating to memorize the Qur'an, since Islamic guidelines govern the usage of physical Qur'ans that do not exist in the same manner for digital devices [5]. For these groups and others, including administrators looking to incorporate digital methods into memorization classes and researchers working to improve current memorization apps, understanding the usage and attitudes towards physical and digital formats can provide critical insights on how to enhance the experience of Qur'an memorization.

1.2. Research Questions

This research attempts to answer the following questions:

1. Does the experience of memorizing the Qur'an change for Muslims when they are memorizing with a physical format versus a digital format?
2. What benefits and challenges are experienced by memorizers of the Qur'an when utilizing each format?
3. How can the tools and processes of memorizing the Qur'an in a traditional or digital format be enhanced for a better user experience?

1.3. Approach

To answer the research questions and contribute to studies examining memory, spirituality and technology, a study was designed where participants were requested to fill out questionnaires, complete a diary study, and participate in an interview. During the diary study, participants were asked to memorize the Qur'an using physical formats (e.g., books, papers, notes) and digital formats (e.g., phone, tablet, computers) for two weeks each. In the subsequent interviews, participants spoke about their experiences and shared if they noticed differences in their memorization experience or connection to God concerning the two formats. Following the study data collection period, quantitative and qualitative analysis was conducted to draw key themes in terms of attitudes, benefits, and challenges related to Qur'an memorization. The findings indicate a perceived difference in using the two formats related to multiple factors and design enhancements to improve the user experience of memorizing the Qur'an for both the physical and digital formats

1.4. Positionality Statement

I am a Muslim American male in my twenties from South Asian origins who has memorized the Qur'an in the United States primarily from a physical book with the occasional usage of audio players and phones to augment my memorization process. Over the last two decades, I have witnessed new applications on PCs, phones, and tablets become available to assist with Qur'anic memorization. I did not pay much mind to this until I came to hear of a Qur'an school announcing an all-digital policy for memorization and instructing every student to memorize the scripture using only iPads when I began to realize how deeply technology had become interlaced into the fabric of scriptural memorization. My identity, motivations, and experiences gave me the insight to propose and create this study and afforded me the ability to code-switch to speak with and include Muslim community members who memorize the Qur'an as part of my research. I also recognize that these factors can bias my approach and research on memorizing Islamic scripture using different formats.

1.5. Overview

The thesis continues with a literature review surveying the intersections of religion, memory, and technology in Chapter 2. Chapter 3 covers the recruitment, selection, procedures, and data analysis followed for this study. Chapter 4 discusses key results and findings from the questionnaires, diary studies, and interviews to answer the three research questions. Chapter 5 presents a discussion based on the findings, the value and contributions of this research, future work that can extend the research that was conducted and a conclusion to summarize key takeaways from the study.

Chapter 2: Literature Review

This study lies at the intersection of memorization, religion, and technology. Each of these topics and the relationship between each topic covers a wide array of knowledge areas and research. For that reason, the literature review will focus on exploring the topic of religious memorization and the impact of digital technology on this practice as that is most relevant to the study. The review covers a survey of the role, practice, and common themes of memorization in major world religions, the benefits and effects of memorization demonstrating the relevance of this research as a course of study, and the sensory modes of interacting with the Qur'an and the pedagogy and education of Qur'anic memorization that provide the necessary context to understand the impact of digital technology. The review also examines studies regarding Qur'an memorization and technology that summarize attitudes towards using technology for memorizing scripture, digital memorization innovations, and the effects of memorizing using distinct formats.

2.1. Memorization in Major World Religions

Memorization is an integral component of all major religions globally due to the practice being seen as an effective method to provide instruction, opportunities for reflection, and spiritual formation to adherents of the faith [16]. The following sections provide a brief look into the practice of scriptural memorization that continues to this day in the five major world religions, arranged by the number of believers reported for each religion [71], followed by a discussion of common themes that emerge from the review.

2.1.1. Christianity

In the Christian faith, Johnson [41] speaks about historical figures such as Cyril, Archbishop of Jerusalem (d. 386 CE), who encouraged believers to memorize catechisms and creeds introduced by the Church, and Benedict of Nursia (d. 547 CE), who prescribed a liturgy of repetitive prayers and Scripture readings that the monks naturally memorized due to daily repetition. In later centuries, St. Thomas Aquinas (d. 1274 CE) provided recommendations on memorizing Biblical scripture, such as the Apostle's Creed, in his magnum opus, the *Summa Theologica*. Martin Luther (d. 1546 CE) instructed parents to teach the Ten Commandments, the Creed, the Lord's Prayers, and other fundamental Christian texts in a word-for-word format to their children for them to commit to memory. The tradition of memorization in the Christian faith continues to this day, with many Protestants incorporating Biblical memorization into the curriculum and instruction of Bible camps, weekend schools, books and digital apps to help adherents internalize the meanings of the Word of God. Certain Christian traditions also extend beyond memorizing scripture in a commonly spoken language. In the Catholic Church, Latin plays an integral part in the liturgy. In the Coptic Church, the liturgy is recited and performed in Copt, a language that has not commonly been spoken for over 1500 years [65].

2.1.2. Islam

In the Muslim faith, memorizing the Qur'an holds an essential and central role as Muslims believe that the Qur'an was not altered in any way since it was revealed to the Prophet Muhammad [21] as a result of a divine assurance from God to preserve

the scripture from any changes. This assurance is manifested in part by memorizing its content by adherents to the faith [18]. Accordingly, a believer who memorizes the entire Qur'an—comprised of 6236 verses in Arabic and taking 20 hours to recite on average—is referred to as a *Hafiz*, or Guardian of the Qur'an [67]. With memorization seen as a foundational step in growing one's knowledge of the faith, Islamic traditions promise heavenly rewards for those who memorize, including receiving a higher rank in Paradise for each verse memorized, the ability to intervene for family members on the Day of Judgment, and honor in the Hereafter for them and their parents [8][39][55]. Memorization of the entire Qur'an is not seen as a practice for only select clergy to perform, but an act of “worship, meditation, and sublime enjoyment” that is encouraged for all believers. It is also a requirement for every Muslim to memorize “some sequences of the Qur'an in order to properly perform the ritual of their daily prayers...as one means of embodying knowledge” [17].

2.1.3. Hinduism

In the Hindu faith, memorization of the Vedas, containing hymns of gods and leaders, has transpired in a tradition of oral transmission for over three thousand years [58]. While priests and adherents will memorize texts that exist in a written form, many will study under a guru to learn the content and meanings of their scripture and to “learn how to vocalize the texts with the correct stress, pitch and rhythm; that can be achieved only by listening to the guru's sound and retaining it” [30]. Many Brahmin youth begin learning Vedic texts at the age of eight and have traditionally focused on rote memorization, emphasizing correct wording and intonations. Some then shift

their focus to understanding its meaning and explanations in later years once they have completed their memorization of the texts.

2.1.4. Buddhism

In contrast to what was discussed for Muslim and Hindu practices, the Buddhist faith emphasizes understanding the content over the form from the start. Early Buddhist reciters only initiated the memorization and oral transmission process at a mature age. They would exclusively memorize material that they understood since the focus of memorization was to use these texts for public preaching. However, this may have led to the minor variations found when comparing Buddhist oral transmissions and their translations in various languages. Scholars have hypothesized that these variations exist because Buddhist reciters would frequently draw inferences while reciting texts as their recollection method. Because inferences are understood to be stored in one's memory together with the original material and can lead one to believe the imagined to be palpable beyond any doubt, it can make it more difficult for a reciter to recollect the exact wording of texts. This theory is supported by studies showing that memorizers who did not understand what they were learning could recall texts more precisely, even after long periods [11].

2.1.5. Judaism

Jewish communities worldwide learn to read, recite, and memorize Biblical Hebrew to fulfill religious responsibilities, even if they are not native speakers of Hebrew [65]. Some Jewish texts explaining religious law, such as the *Mishneh Torah*, were

written by scholars in a way to make it “easy to know...by heart” and “arranged in memory” [29]. Memorization is typically seen as a practice among Jewish adherents when a child prepares to become a Bar or Bat Mitzvah, an essential rite of passage to adulthood that often includes testing the celebrant’s stock of knowledge. In Eastern Europe, the ceremony will include the young adult reciting memorized passages from the Torah and Talmudic law. In other regions, they will showcase their ability to memorize a prayer, the Hebrew alphabet, or a speech typically beginning with ‘Today, I am a man’ celebrating their coming of age [26]. There are also reports of Jewish mnemonist groups such as the Shass Pollaks in 1917, who memorized the entirety of the Babylonian Talmud spanning 12 books and 5000 pages and could reference the precise location of any word on any page in the Talmud, including when randomly opened by someone else [73].

2.1.6. Common Themes & Discussion

In reviewing the memorization practices of religious communities, a few common themes emerge in that scriptural memorization is encouraged as a practice to grow in spiritual development, typically taught to children to provide them a foundation for later developmental years and can include content that is not commonly spoken and comprehended but recited for liturgical reasons. The common themes found between all religions demonstrate that studies that focus on the scripture of a specific religion, such as this one, can still prove to be valuable for other faith communities as they consider the impact and repercussion of incorporating technology into their rituals and traditions.

2.2. The Benefits and Effects of Scriptural Memorization

While memorization can be perceived unfavorably compared to other forms of learning, with many emphasizing its ‘rote’ nature, scriptural memorization in Islam and other faiths can be beneficial from a moral, spiritual, and intellectual perspective [65]. The following sections cover an array of benefits and effects related to Qur’anic memorization that has been studied by researchers and scientists that further establish the relevance of this study and future research to assess if the benefits of scriptural memorization are affected in any way when incorporating digital technology.

2.2.1. A Moral Compass

Boyle, in her seminal work studying the practice of Qur’an memorization in Islamic schools in Morocco, Yemen, and Nigeria [21], speaks about how Qur’anic schooling, with memorization being at its core, is focused on developing spirituality and morality through the content and mental and physical discipline through the process. Around the world, parents expressed to her that they made scriptural memorization a priority for their children, hoping that it would assist in giving them direction, finding spirituality and coming closer to God, and becoming upstanding citizens. She shares that she found memorizing as a form of embodiment that went beyond rote repetition and is “seen as fostering an awareness of the presence of God in daily life, of divine mystery, of life and death, of transcendence and peace.”

Berglund shares similar findings in her study of Islamic education in Sweden, saying that the “spiritual dimension of the act of memorising can hardly be overemphasised

since it is the actual speech of God that is said to become embodied through the process of learning the Qur'an's verses by heart" [17]. She shares additional spiritual and social benefits that come from Qur'an memorization, including that the practice serves as a form of empowerment for young pupils since it allows them to engage in ritual prayers without needing to hold a written text. It provides students a means by which to connect and communicate with Muslims around the world that also recite the Qur'an and hold an Islamic worldview and helps them with their social standing in the Muslim community and society since being able to quote and recognize verses from the Qur'an is seen as a mark of a good education.

2.2.2. Academic and Cognitive Effects

Many in the Muslim community believe that memorizing the Qur'an enhances their cognitive capabilities and provides them with success in this world and the Hereafter. As a result of memorizing thousands of spiritual verses, they hold that the rigor of the process and the blessings of the content contribute to personal benefits in all aspects of life, including their academic and professional careers and later on in old age. Students have said that it helped them learn better in certain subjects, such as science and foreign languages [19], with memorization as part of the coursework. Some have observed that students experiencing Qur'anic literacy regularly also develop as competent decoders of other scripts, including English, and that while there can be a gap of comprehension, there is a significant transfer of reading behavior and accuracy from mosque studies to the school [65].

Some researchers have sought to prove the academic and cognitive benefits of scriptural memorization, reporting that memorizers of the Qur'an had better academic achievements [55], scored higher results on mental health questionnaires [77], and were tested to have a lower probability to develop memory disorders and diseases such as Alzheimer's [3] when compared with those who had not memorized the Qur'an. However, other scientists have contested the conclusiveness of these results, stating that the data collected was subjective and factors such as educational qualification and demographic data could have been responsible for the results [62].

A recent study investigating the association between scripture memorization and brain tissue has shown more promise in being empirically rigorous. Using magnetic resonance imaging (MRI), researchers in Nigeria, the UK, and Pakistan found that participants who memorized the entire Qur'an had more extensive grey matter, white matter volume, and brain tissues preserved than the control group, indicating that memorizing scripture may increase brain health through the maintenance of cognitive reserve [62]. These results have been corroborated with other studies which found significantly more grey matter volume in Sanskrit verbal memory specialists than the control group [36], in professional musicians than amateur and non-musicians [38], and in those who have more proficiency in a second language, particularly with earlier acquisition of that language, than monolinguals [46]. Further research on this topic can be conducted to see if similar results are found when utilizing digital devices for memorization, including if different parts of the brain are activated when memorizing and viewing the scriptural content from a screen.

2.3. Sensory Modes of Experiencing the Qur'an

2.3.1. An Oral Phenomenon: Recitation Guidelines

Nelson [56] speaks about the Qur'an, which linguistically means "the recitation," to be a fundamentally oral phenomenon with its transmission and social existence both being essentially oral. She argues that Western researchers have mistakenly approached studying the Qur'an as a collection of written texts, similar to how scriptural scholars have studied the Bible, and that instead, they should view it primarily as a mode of recitation.

Graham [31] expounds on this concept, "In Muslim piety, however, the written word of its scripture has always been secondary to a strong tradition of oral transmission and aural presence of scripture that far surpasses that of Judaic or Christian usage," referring to the functions of the Qur'an as an oral text that is recited by believers daily during prayers and liturgies and by students when memorizing the Qur'an. For early Muslims, Graham shares that they used the written text as an aide-mémoire to the oral composition and not the other way around as is common today. They trusted their memories due to the regular recitations they engaged in, verified the accuracy of their recollection of the scripture through reciting to one another, and taught their children the Qur'an primarily through oral methods as well, only introducing a physical Qur'an later, if at all.

In order to preserve the oral composition of the Qur'an from generation to generation, Nelson discusses the stringent guidelines of recital found in Qur'anic studies, known

as *Tajwid*, which is defined as a science of recitation authorized by a divine command that regulates “the correct oral rendering of the Qur’an...which govern many of the parameters of the sound production, such as duration of syllable, vocal timbre and pronunciation.” She emphasizes the importance of *Tajwid* by saying that learning how to recite and memorize correctly according to *Tajwid* keeps the oral nature of the Qur’an intact and that it is in the proper recitation that one sees and recognizes “the ideal beauty and inimitability of the Qur’an [due]...to the use of the very sound of the language to convey specific meaning...[in] an almost onomatopoeic use of language.” Learning the Qur’an with *Tajwid* cannot be studied only from written texts, as the “definitions do not guide the student to producing the intended sound; rather, they identify a sound which the student has heard and learned by imitation.” Rather, it has to involve an element of hearing the oral content and recitation [56].

For this reason, students will study *Tajwid* from a teacher and use their textbooks and notes as just a guide since one cannot learn all the rules of articulation from just reading a book. Students will learn how to recite the Qur’an with *Tajwid* orally from a young age, and even after learning how to read the written text, they will continue to recite the Qur’an aloud when in private, during congregational prayers, and when teaching the oral content of the scripture to others [56]. This practice is essential to understand in the context of memorizing the Qur’an using digital formats, as students would be able to benefit from using an app’s auditory features of recitation and repetition to learn and practice *Tajwid* and engage in more self-learning and memorizing on their own.

2.3.2. A Physical Scripture: Interaction Guidelines

Honoring the Scripture

Believers are encouraged to respect the physical Qur'an, place the scripture in a high place "so that it will be exalted in both the literal and metaphorical sense" [6], be clothed and avoid taking it to restrooms when reciting it and keeping it in one's possessions [61]. In some African countries such as Senegal, Mauritania and Sudan, where students memorize using a traditional method of writing from memory on a wooden tablet [69], the students will wash the tablets in a particular basin in order to reuse the wooden tablet for the next lesson and to make sure the water does not mix with other wastewaters as a form of respect [23]. Some adherents will drink Qur'anic texts written with saffron, rosewater, and charcoal inks for their blessings or as a form of medication [40][79].

When disposing of old or torn copies of the scriptures, scholars do not allow discarding the scripture away as refuse and instead stipulate that the worn copies should be buried, burned, put in flowing water, or finely shredded in a way that God's name and words no longer appear on the page [5]. As for devices that have a digital copy of the Qur'an downloaded onto them, it is generally permissible to take the phone anywhere and to use it in any way [14]. However, scholars advise that believers should be conscientious about avoiding committing sins with a digital device, such as watching pornography, that is also used for Qur'an recitation and memorization, as it is considered a sin in Islam and can be considered "a sign that one does not revere the Qur'an as one should" [34].

Ritual Purity & Menstruation

Scholars of Islamic law have permitted and encouraged holding and reading a physical Qur'an to use for recitation and memorization for Muslims of all ages and genders, except in certain circumstances when one has engaged in sexual intercourse but has not taken a ritual bath yet, or when a woman is on her menstrual cycle [64]. Many add a requirement to be in a state of ritual ablution, which involves washing one's face, hands, arms, head and feet, before touching the Qur'an [13]. For men, this will mean they can enter into a state of ritual purity to touch a Qur'an within a few minutes of a bath or an ablution, but for women, this could mean several days during their menstrual cycle when they cannot touch a Qur'an.

Some jurists, based on their interpretation of Islamic scriptures, have made an exception for menstruating women who actively teach or study Qur'anic memorization, read quietly but do not recite aloud, or recite with the specific intention of performing their daily liturgies and supplications to remember God but not to engage in studies [60][64]. Others allow menstruating women to hold the Qur'an if it is wrapped up in a cloth or if it contains commentary and translations of the scripture as a significant portion of the book [64][14]. In terms of reciting and memorizing the Qur'an from a digital device, scholars of Islamic law, except for some [13], allow reciting the Qur'an without any restriction and say that it "makes it easy for women who are menstruating and one who cannot easily carry a [physical Qur'an] with him, or one who is in a place where it is difficult for him to do [the ritual ablution]" [5].

For Muslim women, these rulings can mean that many will not touch or recite the Qur'an for several days while they are menstruating. They may not be aware of the mentioned exceptions for touching a physical Qur'an or decide not to follow those opinions. In a survey of 584 Muslim women in Turkey, more than 94% of women "reported believing that they should neither touch the Quran nor read it while menstruating" [22]. Muslim women in India echoed similar sentiments when asked about their beliefs on touching the Qur'an during menstruation as well [20]. However, in terms of digital devices, many women have found it permissible and convenient to utilize the devices to read Qur'an during menstruation [43]. This finding means that digital technology provides opportunities for the Islamic scripture to be accessible for more Muslim women during all days of a month and removes barriers to entry for them to engage in Qur'anic memorization.

2.4. Pedagogy & Education

2.4.1. Learning the Qur'an

Students learning in a classroom setting may study in a variety of environments, including full-time in a traditional *madrassa* with one teacher overseeing students of multiple grades, in preschools, in an after-school class, or in private schools that offer secular subjects similar to public schools, but also provide Qur'anic memorization as a subject [21]. In these varying contexts, the students will use various techniques to memorize the Qur'an, including applying repetition, reading a translation of the Arabic in their language, chunking the task, listening to recitation audio, and reciting to their peers and teachers [8].

The students read and memorize the Qur'an in Arabic, a language that is not spoken as a native tongue by the majority of Muslims [28]. Rosowsky shares that even native Arabic speakers will find the classical Arabic found in the Qur'an to be vastly different in terms of register, style and vocabulary than how they speak the language now. In some respects, their experience is similar to speaking Shakespearean English, which crystallizes a particular moment in history but is different from the spoken English language found four hundred years later in the current age. As a result, students will typically use techniques specific to scriptural memorization, such as repeating words after a teacher, but will need to utilize different learning methods when they are in a class such as English Literature where they are required to comprehend the classroom texts [65]. The students will benefit from learning varied techniques to handle memorization and comprehension exercises in different contexts, but it could prove overwhelming for some.

As part of their memorization journey, students will typically study subjects that are relevant to the Qur'an either to understand the content better or to enhance their memorization skills. In addition to studying the previously mentioned subject of *Tajwid* to articulate each word correctly, Berglund [17] covers other subjects that students will study, beginning with a discussion on *Tafsir*, or Qur'anic exegesis and scholarly commentary to explain the meaning of the Qur'an. *Tafsir* is viewed as a science that requires years of advanced study of the exegetical literature and has not historically been studied in the beginning years of a Muslim's Qur'anic education. In place of detailed commentaries, students will study and learn the vocabulary and

grammar of Qur’anic Arabic to assist them in the pursuit of memorization. Berglund mentions that students will also learn Arabic calligraphy to write the Qur’an in a beautiful and befitting style to reflect that it is the speech of God and to use it as a memorization technique to remember the Qur’an.

Following these core subjects, Berglund shares that many students will study “hadith (stories concerning the deeds and sayings of the Prophet and his close companions) and fiqh (Islamic jurisprudence).” In the current digital age, there are apps, online courses, and streaming services where a student can learn each of these subjects in order to grow a closer connection to the Qur’an and to find assistance in their endeavors to memorize the entirety of the message [32]. There is an opportunity to integrate these resources as part of a participant’s online Qur’an memorization experience in order to craft a better user experience for them.

2.4.2. Teaching the Qur’an

Boyle [21] writes about the centrality of knowledge in Islam, sharing that it is referred to in the Qur’an over 750 times, ranking only behind ‘God’ and ‘Lord’ in frequency and that Muslims will start with teaching Qur’an memorization to begin the path of knowledge for their children. He shares that Muslims focus on memorization when it comes to the Qur’an due to it being seen as divine and fixed knowledge, while other techniques are utilized to teach knowledge seen as derived from reason, such as the physical universe, the human mind, and history. Regarding Islamic education overall, Boyle shares that it “has a narrower initial focus and broadens over

time,” whereas “Western education begins with a broad focus and moves towards narrower specialization. A student studying the Islamic tradition will start with memorizing the Qur’an and then broaden the range of topics studied as they grow older. In contrast, in Western education, a child will typically start with a wide variety of subjects from a young and then begin to specialize as they work on their secondary and post-secondary education.

He references the renowned Islamic scholar Al-Ghazali, in this regard, who said that a child should first be taught to commit concepts to memory so that “the meaning of it will keep gradually unfolding itself to him, point by point, as he grows older. So, first, is the committing to memory; then understanding; then belief and certainty and acceptance” [21]. From the perspective of digital technology, it can be a point of further research to see if and how teaching and learning are constructed differently to meet the different pedagogical models and associated needs.

In the classroom, Berglund [17] writes about the considerations she observed Islamic School teachers have when teaching their students how to memorize the Qur’an. She says that teachers will choose to prioritize explaining the Arabic words at a later time with the reasoning that it could be too difficult for young pupils to grasp and that it would be better suited for when the student matures in their intellectual capacities and naturally begins to inquire about and understand the content of the Qur’an. Teachers will try to individualize the memorization experience where possible, considering a student’s capacity for memorization, the amount of assistance they receive at home,

and the level of interest and enjoyment they show in class. To bolster the students' motivation, teachers will often use techniques such as class competitions to see who recited or memorized the best, a practice established in Qur'anic memorization teaching practices since the 9th century.

With the advent of the digital age, more research needs to be conducted to see how utilizing digital formats for memorization will affect teaching methods. For example, what will the role of a teacher be when a student can use a digital app to read Arabic, learn the English translation, and listen to the audio recitation? How will teachers ensure that students are using reliable and accurate sources of knowledge when studying the tradition online? How can the teacher incorporate digital technology to provide an immersive experience while avoiding challenges that could be posed, such as distractions and information overload for the students? There is still much to examine concerning the intersection of technology and Qur'an pedagogy.

2.5. Qur'an Memorization and Technology

2.5.1. Attitudes Towards Digital Recitation & Memorization

In an international online survey [43] conducted in 2013 regarding reciting and memorizing from a digital copy of the Qur'an that collected 668 responses for 17 questions, researchers found that participants found the digital formats to be convenient in that they were portable during travel, did not require ablution to recite, and could be used by women during their menstrual period. In contrast to a physical Qur'an, digital formats provided privacy from onlookers, could be taken to the

restroom and allowed for easy searching. The participants shared concerns that using a digital device could lead to weak eyesight, losing the reverent feeling of holding a sacred book, and diminishing the respect and sanctity of the holy book.

Some participants also spoke about the need to know if the apps they were using were trustworthy and accurate due to their encountering fake digital copies of the Qur'an online that were intentionally fabricated. In one example, missionaries of other faiths altered verses to advocate for concepts such as Trinitarian theology that contradicted monotheistic beliefs mentioned by an authentic Qur'an. Some were concerned about finding content mistakes in the apps they were using (e.g., words displayed in an incorrect order or missing from the pages). In another survey conducted by the authors in 2009, they found that almost 80% of participants had used various technologies for assisting in Qur'an memorization and recitation [76], showing the proliferation and acceptance of using a digital Qur'an for memorization.

2.5.2. Digital Innovations for Memorizing the Qur'an

Currently, there are over 200 apps related to digital Qur'anic memorization [43] that offer features allowing a user the ability to read the Qur'an including in a layout that matches a physical Qur'an, bookmark and tag specific pages, highlight verses, read translations and commentaries, search topics and content, and listen to audio recitations from many reciters [70]. However, there is a concern that most apps have ceased innovating on their features and are essentially "a digitalized version of the classical methods used in preaching or teaching...offering the same conventional

styles of teaching with the only difference of replacing the [teacher] by a machine” [63]. To this end, researchers and app developers have been looking into novel ways to improve the instruction and experience of users interacting with digital memorization apps.

Researchers have proposed implementing metacognitive strategies such as visualization techniques and mind mapping to connect verses, as they found that these approaches can enhance the performance of one’s memorization in terms of time and understanding [4]. Some are looking to incorporate game design theory elements, utilizing game mechanics and game aesthetics, in a game-based memorization application designed for digital natives that provide constant feedback and instruction. Their goal is to eventually introduce a multiplayer platform that would allow players to “help each other to memorize, motivate, and recollect, while pursuing the higher goal of meaningful engagement with the Qur’an” [51]. Others are looking to maximize memorization efficiency through using term frequency and the Pareto principle to display common phrases that appear in multiple places on an app that a student can memorize, thereby learning the Qur’an more quickly [24].

To make the Qur’an more accessible for more Muslims to recite and memorize, a team of researchers and developers in Malaysia are working to create a digital braille Qur’an using an electronic Braille panel with a built-in sound module for blind or visually impaired memorizers [66]. Others are working to make the learning of the Qur’an more engaging and usable for young children diagnosed with low-functioning

autism (LFA) through experimentation and co-creation using digital game-based learning processes and related prototypes [42]. For students that may not have local access to a Qur'an teacher, need assistive technology, or prefer learning on their own, researchers have been working on an "E-Hafiz" application. It utilizes speech recognition techniques and the Mel-Frequency Cepstral Coefficient (MFCC) as the feature extraction method to listen to verses recited by users from memory and alert the user on any detected mistakes. Boasting an 86% accuracy rate for women and 92% accuracy for men on a sample number of verses and recitations, the tool will allow for memorizers to test themselves and find any mistakes they make without needing the help of another person [52]. Others are working on comprehensive e-learning systems that allow for distance learning with live instructors, self-guided modules on Qur'an subjects, resources to teach the stories of the Qur'an visually, and online classes at different levels where students are separated into smaller groups based on their age and ability of memorization [63][80].

2.5.3. Comparing Digital and Physical Methods

There has been one study directly related to this research that was conducted in 2017 by Marwan Tawfiq, which examined the effects of participants memorizing the Qur'an using a digital method versus a physical method [75]. Studying the memorization methods of 99 kindergarten students in Iraq, Tawfiq had experimental groups that utilized an electronic learning software where students could listen to different chapters in the Qur'an on an interactive interface, and control groups that memorized using the traditional method of a physical Qur'an. To ensure the integrity

of the test, Tawfiq selected students who were similar in age and academic achievements and had parents—who would presumably be helping their children study at home—with similar educational qualifications. The students were given similar passages and instructed to use the same software to memorize over 14 weeks. Afterward, all participants were tested on their memorization in front of an expert panel of Qur'an judges.

The results are reported to have had a statistically significant difference based on the Pearson correlation coefficient, with the students who memorized using an electronic method consistently scoring better than those who memorized using a physical method. Out of 10, an experimental group reported 8.60 and 1.349 as their respective average score and standard deviation, while the corresponding control group reported 5.84 and 1.068. The study provides value in beginning to look at the effects of Qur'an memorization using digital and physical methods. However, more research needs to be done to understand the experiences from a qualitative perspective and to perform similar studies with older participants, including those who were introduced to digital devices later on in their life.

Chapter 3: Methodology

For this qualitative study approved by the Institutional Review Board (IRB) at the University of Maryland, participants were asked to fill out questionnaires, engage in a monthlong diary study to memorize Qur'an using physical and digital formats for two weeks each, and complete a post-study interview. The questionnaires provided a mechanism to select participants against predetermined criteria and receive demographic data to understand participants' experiences better. A diary study was selected for this research to stimulate an environment where participants had sufficient time to memorize both formats and provide meaningful feedback. The post-study interview afforded participants the ability to share additional perspectives as they reflected on their experiences during the study.

3.1. Recruitment

Participants were recruited using online advertisements, flyers, social media posts, and letters to Islamic school administrators (see Appendix 6.1) that explained the incentives of being part of the research and included compensation details. Through snowball sampling and sending flyers to known acquaintances and social media personalities with large followings and asking them to share it with their networks, the online postings garnered over 20,000 impressions and 1100 engagements on social media and led to over 80 participant interest form responses in three days. There were also plans of running paid advertisements using funds from a Research Improvement Grant received, but due to the responses received from organic social media reach, the funds were instead used towards participant compensation.

3.2. Eligibility

Participants were required to be Muslim, 18 years old or above, and living in the United States of America. They had to consent to complete all necessary diary logs, surveys, forms, and interviews as outlined in the procedures and agree that compensation will only be given if they completed the study in its entirety. The criteria to be Muslim was given since the study is about Islamic scripture, and the research objective is to understand impacts on participants' sense of spirituality and connection to God and the Qur'an as a result of the memorization. The age criteria of 18 years or above were given since that was determined to be an adequate age to receive meaningful qualitative feedback and capture responses from age groups not found in similar studies [75]. Participants were required to live in the United States to avoid conducting international research and make it easier to provide study compensation. The criteria to complete the procedures mentioned were given to confirm the commitment necessary to complete the study and receive sufficient information from participants.

3.3. Participants

The goal was to have 15 participants successfully complete the study. Keeping in mind that attrition rates can be as high as 70% for longitudinal studies [47] spanning a few weeks or more, efforts were made to secure at least 35 participants to complete the consent form and be ready to begin the diary study. To garner a diverse population of participants and avoid a situation where all participants were from the same demographic profile, participants were reached out to in a phased manner to fill

the consent form. Nineteen participants matching the selection criteria targeted for the study (see Table 3.1) were contacted a month before the diary study period, followed by smaller batches approached in the days leading up to the diary study based on which demographics were still needed to meet the targeted selection criteria.

The selection criteria were chosen to include demographics of gender, race, age, and employment to learn from as wide of a spectrum of participants as possible. Other factors were secondarily considered when multiple applicants were meeting the same criteria, including how many pages of the Qur’an they already memorized and what format they typically used to read and memorize the Qur’an, ranging on a spectrum from always memorizing with a digital device to utilizing both formats equally to memorizing with a physical Qur’an at all times.

Table 3.1 – Targeted population demographics to include as part of the study. The parentheses denote the number of participants targeted for each category.

Gender	Race	Age	Employment
Female (7)	Black or African American (2)	18-24 (2)	Self-Employed (2)
Male (7)	White or Caucasian (2)	25-34 (2)	Student (2)
	Asian or Pacific Islander (2)	35-44 (2)	Homemaker (2)
	Multiracial or Biracial (2)	45-54 (2)	Employed Full-Time (2)
	Ethnicity Not Listed (2)	55-64 (2)	Employed Part-Time (2)
		65-74 (1)	Unemployed (2)

Of the 80 participants invited in a phased manner to begin the study, 38 participants completed the consent form, 35 participants completed at least one diary entry, and 23 participants completed the entirety of the study. Therefore, the 39% attrition rate

was better than anticipated when compared to 70% for other longitudinal studies. The demographic breakdown of the participants who started and completed the study showed a relatively balanced distribution across most demographics and categories (see Table 3.2, Figure 3.1, and Figure 3.2). However, in terms of race, most participants who completed the study were Asian or Pacific Islander, which is also mentioned as part of the study results and limitations.

Table 3.2 – Demographics of participants who started and completed the study, depicted as percentages segmented by gender, race, age, and employment.

Demographic	Identification	Started (N = 38)	Completed (N = 23)
Gender	Female	55%	61%
	Male	45%	39%
Race	Asian or Pacific Islander	63%	74%
	Black or African American	11%	4%
	Multiracial or Biracial	5%	0%
	White or Caucasian	11%	13%
	Race or Ethnicity not listed	11%	9%
Age	18-24 years old	42%	43%
	25-34 years old	29%	22%
	35-44 years old	8%	9%
	45-54 years old	13%	13%
	55-64 years old	5%	9%
	65-74 years old	3%	4%
Employment	Employed full-time (≥ 40 hrs/wk)	47%	39%
	Employed part-time (< 40 hrs/wk)	13%	17%
	Homemaker	5%	4%
	Retired	5%	9%
	Self-employed	3%	4%
	Student	26%	26%

Figure 3.1 – Participants’ typical format of memorization before the research study, color-coded by participants who started but did not complete the study (n=15) and those who started and completed the study (n=23)

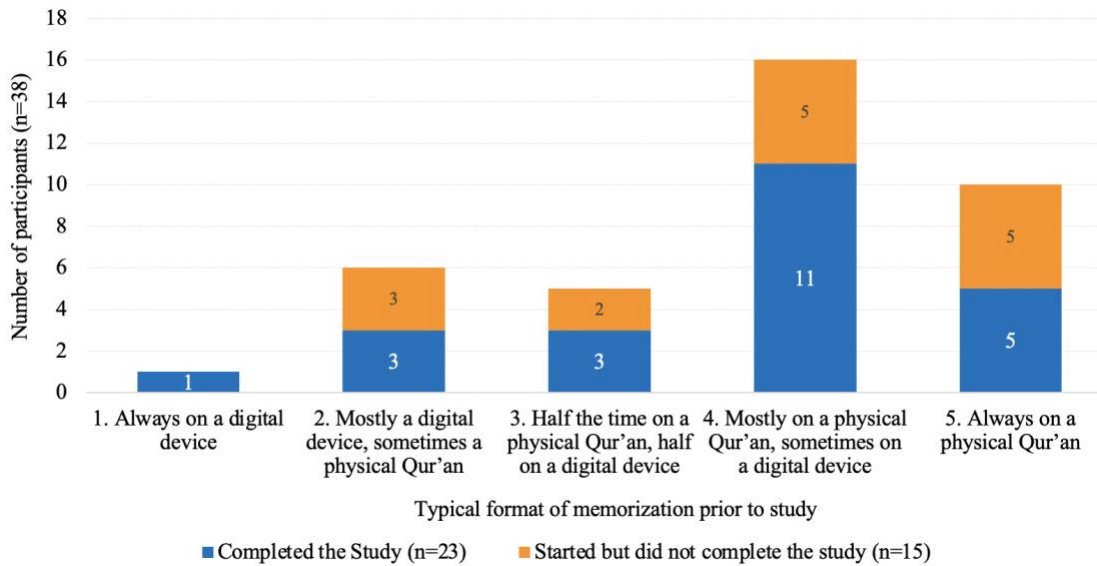
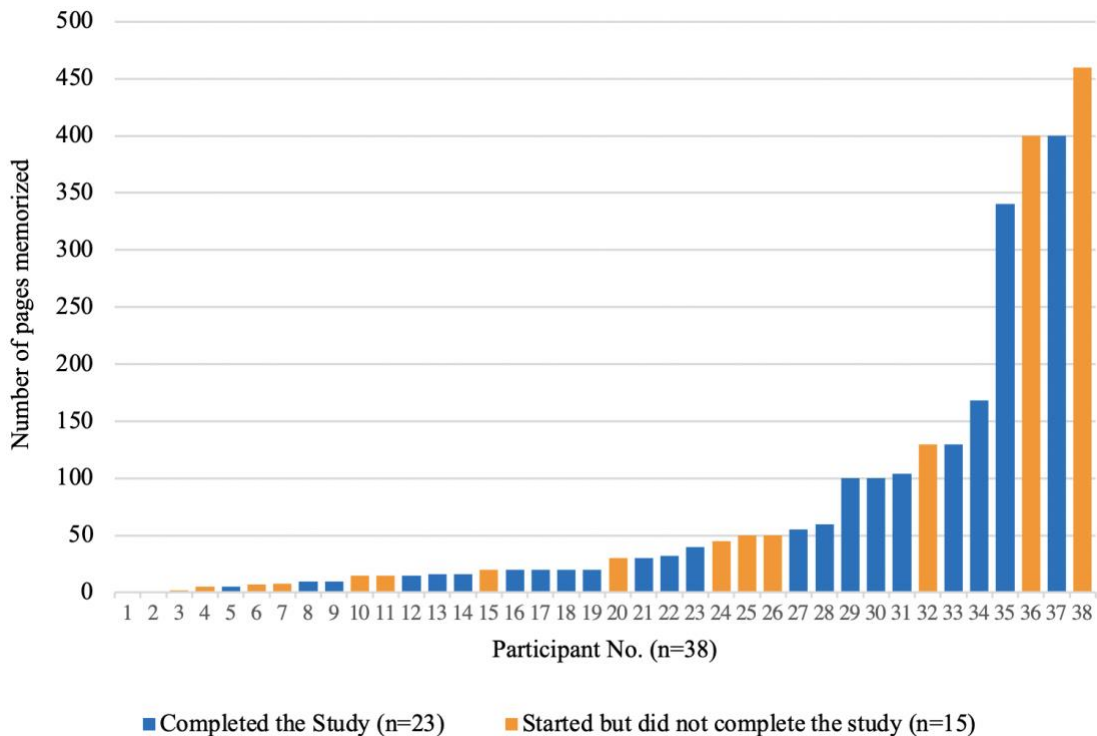


Figure 3.2 – Number of pages memorized per participant before the research study, color-coded by participants who started but did not complete the study (n=15) and those who started and completed the study (n=23)



3.4. Procedures

3.4.1. Questionnaires

Prospective participants were asked to first fill out a participant study interest questionnaire (see Appendix 0) in order to be considered. Based on the responses received, a diverse and representative set of participants was selected to prioritize gender, race, age, and employment status, as discussed in the previous section. Once selected, participants were asked to fill out a consent form (see Appendix 6.2) using Adobe Sign and a pre-study questionnaire (see Appendix 6.4) that captured more information about them, including their current level of reading and memorization, Arabic reading proficiency, and self-attested level of connection to God.

3.4.2. Diary Study

On February 1, 2021, participants were informed via email (see Appendix 6.7) that the diary study period had begun. They were to memorize using a physical Qur'an for two weeks and a digital device for two weeks and log their experiences daily for every day they memorize on an online diary form (see Appendix 6.5), which asked them how much and how long they memorized, level of difficulty, and any other feedback they wished to log. They were also assigned a memorization format based on their responses from the pre-study questionnaire. Participants that indicated they used both formats equally were randomly assigned one. If they indicated a primary format, they were instructed to begin the study with another one (e.g., if they typically memorized with a physical Qur'an, they were asked to begin memorizing with a digital device). As a result, participants experienced a new format from the onset and

could provide more meaningful feedback than if they had continued with their customary practices for the first two weeks. They could also report if they missed their typical memorization format or found an adequate alternative when reverting to their typical method of memorizing in the latter half of the study.

The instructional email asked them to memorize for at least 20 days out of the month, which was done to lower the anticipated attrition rate since most participants were inevitably going to miss at least 2-3 days of memorization, and to accommodate breaks on the weekends or any situations or emergencies that the participants may face that would impede their ability to memorize for that day. The email also set expectations on reminders, sharing that reminders will be sent three times a week via SMS based on whether or not the participant had logged enough responses for that week (see Appendix 6.8 for details on the cadence) and that participants had the option to change the frequency and method of reminders. Some of the participants (n=4) set up a different cadence for reminders based on this option.

On a daily basis, a dashboard built to analyze the diary form responses was checked (see Figure 3.3) to see how many participants filled out the diary questions and which ones needed a reminder, to resolve any form errors such as duplicates and incorrect dates inputted, and to confirm that participants memorized using the correct format for that week. In case any issues were found, the participant would receive a note asking for confirmation or updates of the information provided (see Appendix 6.7), and corrections would be made as needed. For participants identified to have missed

filling out the diary log for three consecutive days, a note would accompany their scheduled reminder inquiring about their wellbeing and if they would be able to continue with the diary study. As a means of motivation, encouraging emails would be sent every week to all participants, letting them know about how much they collectively memorized (see Appendix 6.7 for an example).

Figure 3.3 – Dashboard to track participants’ diary responses. A participant’s entry would be highlighted as red instead of green if errors were found. Entries were highlighted as grey and not counted if the participant did not complete the study.

ID	Format 1	Format 2	Completed	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	Total	
P25	Digital Device	Physical Qur'an	No		1																											1	
P29	Digital Device	Physical Qur'an	No		1																												1
P38	Digital Device	Physical Qur'an	No		1																												1
P26	Digital Device	Physical Qur'an	No	1		1																											2
P34	Digital Device	Physical Qur'an	No		1					1																							2
P28	Digital Device	Physical Qur'an	No		1	1		1																									3
P37	Physical Qur'an	Digital Device	No		1							1				1																	3
P32	Digital Device	Physical Qur'an	No		1		1			1			1																				4
P31	Digital Device	Physical Qur'an	No	1	1	1	1	1				1											1										7
P35	Physical Qur'an	Digital Device	No	1	1	1	1	1		1	1		1					1															10
P24	Digital Device	Physical Qur'an	No		1	1	1	1		1	1	1	1				1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	15
P01	Physical Qur'an	Digital Device	Yes	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P05	Physical Qur'an	Digital Device	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P09	Digital Device	Physical Qur'an	Yes	1	1	1		1	1	1		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P10	Physical Qur'an	Digital Device	Yes	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P12	Digital Device	Physical Qur'an	Yes	1	1			1			1		1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P13	Physical Qur'an	Digital Device	Yes	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P16	Physical Qur'an	Digital Device	Yes	1	1		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P17	Digital Device	Physical Qur'an	Yes	1	1	1			1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P18	Digital Device	Physical Qur'an	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P20	Digital Device	Physical Qur'an	Yes		1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P21	Digital Device	Physical Qur'an	Yes		1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P22	Digital Device	Physical Qur'an	Yes	1	1	1	1			1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P23	Physical Qur'an	Digital Device	Yes	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
P11	Digital Device	Physical Qur'an	Yes		1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21
P14	Digital Device	Physical Qur'an	Yes		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	21
P06	Digital Device	Physical Qur'an	Yes	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	22
P19	Physical Qur'an	Digital Device	Yes		1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	22
P08	Digital Device	Physical Qur'an	Yes			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	23
P03	Physical Qur'an	Digital Device	Yes			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
P15	Physical Qur'an	Digital Device	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25
P04	Digital Device	Physical Qur'an	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26
P02	Digital Device	Physical Qur'an	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	28
P07	Digital Device	Physical Qur'an	Yes	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	28
Total from Selected:				23	11	19	17	18	16	13	19	18	16	19	18	16	17	17	18	22	19	23	18	18	19	20	19	20	20	17	17	16	500

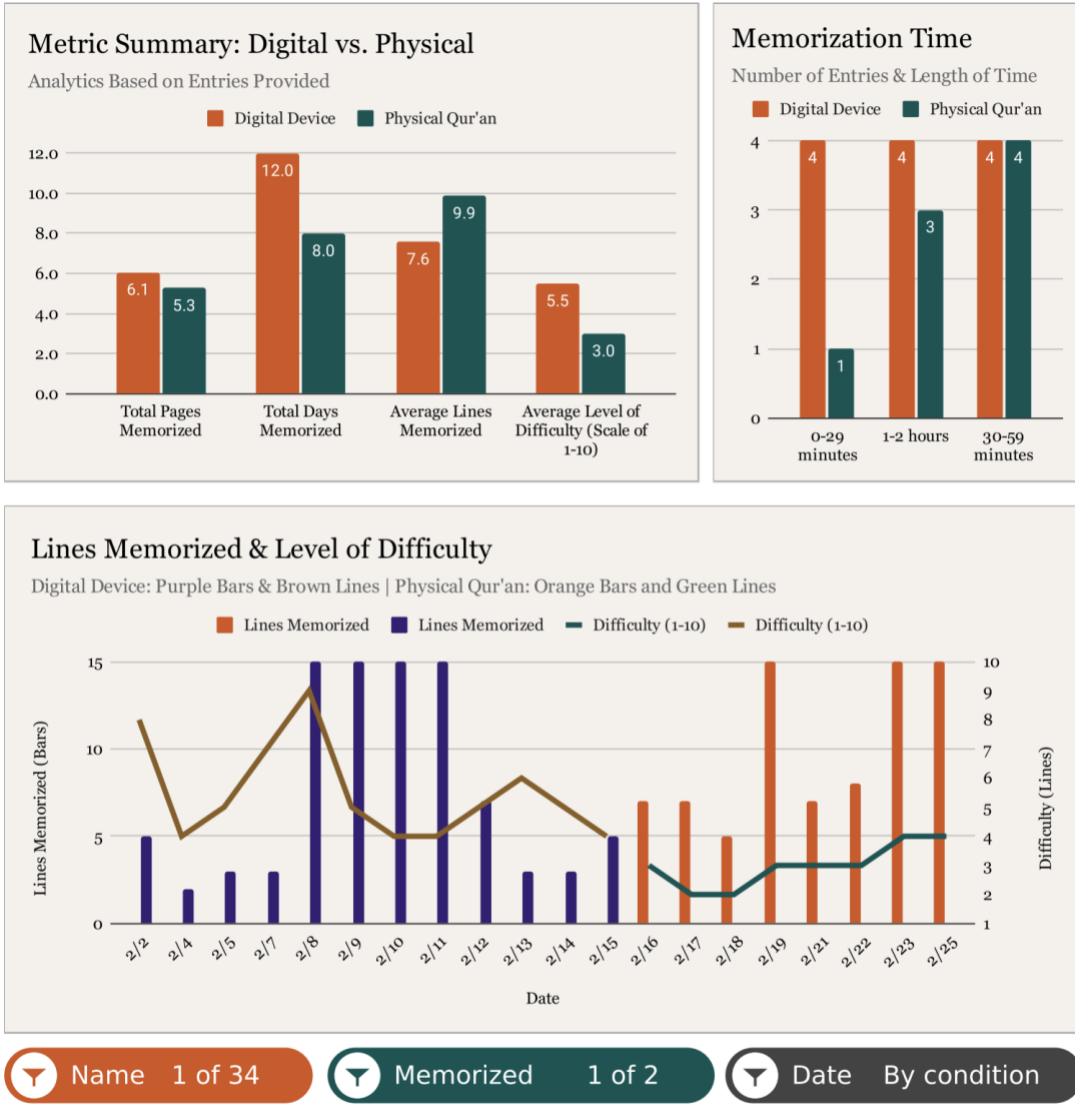
At the halfway mark of the study period, on February 15, 2021, participants received an email reminding them to change the format of their memorization. As this was the time when most participants were reverting to their usual method of memorization, special consideration was given in reviewing diary logs during this time to see how participants were reflecting on the first phase of the experiment they had been involved in and to understand how participants were feeling about returning to their standard memorization format.

3.4.3. Interview

On February 28, 2021, emails were sent to participants who completed at least 20 entries during the monthlong study period, asking them to schedule a Zoom post-study remote interview on Calendly.com by March 10, 2021. Once the interview was scheduled, they were sent a personalized report (see Figure 3.4 and Figure 3.5) that visually displayed key metrics grouped by the format of memorization, including how many pages and lines were memorized, how many days they submitted a diary form, how long they memorized for, and how difficult the experience was on average. The report also contained a chart comparing lines memorized with reported difficulty and a table displaying a summary of their diary responses. The participants were asked to review the report in preparation for the interview and reflect on their experience. The reflections would empower them to come to the interview with a heightened sense of awareness about their memorization metrics during the study period and be ready to interpret the data from their perspective.

During the interview, conducted online over Zoom, the personalized report would be reviewed together between the researcher and participant. The participant would be given a chance to explain the data from their viewpoint and then would be asked about significant relationships between data elements as noticed by the researcher. For instance, in the example shared in Figure 3.4, the participant may be asked why they memorized for more days and for longer timeframes using a digital device when they indicated the level of difficulty of a digital device to be close to double that of a physical Qur'an.

Figure 3.4 – First page of a sample personalized participant report that included metrics on total amounts memorized, days memorized, levels of difficulty, and how much time was spent in each session of memorization



The three filters above denote that the report is filtered by name, by entries that indicate the participant memorized that day, and by dates within the study time period.

Figure 3.5 – Second page of a sample personalized participant report that provided each participant their inputted diary entries and corresponding memorization format, date of entry, level of difficulty (scale of 1-10), and lines memorized

<i>Format of Memorization</i>	<i>Date</i>	<i>Please add 1-2 sentences of details from your memorization experience today.</i>	<i>Difficulty (1-10)</i>	<i>Lines Memorized</i>	
Digital Device	2/2	Today my mood wasn't good but memorizing in the digital devise was hard as I'm used to flipping pages and having something in my hand	8	5	
	2/4	I took less lines so it wasn't as hard	4	2	
	2/5	Staying focused on a digital device is harder than I thought, but hopefully I will get better	5	3	
	2/7	My mood has been pretty rocky today, I had a mental breakdown so it was really hard to focus and I felt like I kept repeating the same Ayah so many times.	7	3	
	2/8	I just felt like I kept getting distracted and had to make myself focus harder than usual. I'm so used to paper Quran and seeing the Tajweed rules that my eyes would just blur the words and ayahs.	9	15	
	2/9	It's still hard to memorize but I listen to the qari to help but it's still difficult.	5	15	
	2/10	I get distracted easily but it's gotten easier. I memorized dukhan today and finished it. I tried a new technique to read each ayah like 10 times before I moved on and then recited another 10 times to read it from memorization, so that helped	4	15	
	2/11	I used the same technique as yesterday and it helped alot. I worked on jathiya today.	4	15	
	2/12	Today I had a headache but digitally memorizing is getting easy and I can easily switch to the meaning and read the root words so easily	5	7	
	2/13	My mood was pretty good but I was visiting family and getting text messages so I kept getting distracted and it was hard to keep my eyes on the iPad Quran page but I still tried	6	3	
	2/14	Today I focused in my revision and it was hard because I think lines of my old mushaf didn't match up with the lines in the app I using.	5	3	
	2/15	Today was a new day of a new week and I started with a fresh mindset and tried to do the meaning while reading and that so easy with a click of a button I could read it I also listened to the Shaykh and memorizing it became easier.	4	5	
	Digital Device Total				91
	Physical Qur'an	2/16	Oh man it felt so good to be back on a physical copy of the Quran. I could mark my mistakes and figure out how far I read and even jot down some meanings.	3	7
2/17		I listened to the Shaykh and I miss how easy it was to read the meanings but I live seeing all the tajweed colors	2	7	
2/18		I enjoyed holding the mushaf and flipping through the page and seeing my progress and changing my bookmarks even though that's something weird I liked it. I do miss the ease of just listening to the Shaykh, now I have to take out my device and set it all up and it takes time.	2	5	
2/19		Even though I chose to Memorize more from ghafir, since I had my physical mushaf I could stay on top of task and break down the lines for raider and more hands on visual memorization.	3	15	
2/21		I usually teach on Sundays and so.i had the time to spend with my Quran and I feel like I'm getting stronger spiritually and my memorization has been consistent and getting stronger. I should focus more on my revision though	3	7	
2/22		My mood was really good today. I had a good morning routine and did some yoga to clear my mind and then I did my lesson and did some revision too and felt so happy and so good. I listened to the Shaykh from my phone and read the translation from before hand.	3	8	
2/23		I made a new schedule for my lesson and tried to manage my time better. I feel like I can keep this up even after this study is over inshallah.	4	15	
2/25		I've had an amazing time memorizing on the mushaf in my experience I definitely think using a hard copy was better for me mentally rather than using a digital device, I got more memorized and was more confident in doing so as well.	4	15	
Physical Qur'an Total				79	
Grand Total				170	

In addition to reviewing the report, the participants were asked several questions during the interview (see Appendix 6.6), including how they would describe their overall experience and if they encountered any format-related surprises, used any new techniques, or faced any distractions. They were asked to rate their connection to God and their memorization experience using a physical Qur'an and a digital device and to share if they believed one format gave more blessings or made them feel closer to

God. They were also requested to share any challenges they encountered with the memorization formats and suggestions to improve their experiences with memorizing.

As the interview occurred and participants spoke, the participants' answers and associated findings were being transcribed live, with notes and data points also being entered into a spreadsheet for subsequent analysis. At the end of the interview, participants were thanked for their time and arrangements were made to send them their \$50 compensation as a check, Amazon.com gift card or via PayPal.

3.4.4. Data Analysis

The quantitative responses received from the diaries, questionnaires and interviews were used to answer the first research question and analyzed using t-test statistical analysis and data visualization techniques on Tableau and Microsoft Excel. The data was explored to see if relationships existed within demographics such as gender, race, age, and employment, as well as categories such as the format participants typically memorize with, the number of pages they memorized, their Arabic language speaking and reading proficiencies, and how often they memorize the Qur'an. The exploration effort revealed that there was generally an equal distribution of results without any statistical differences found in these classifications except when it came to gender, further reinforced by the interviews where some participants expressly spoke about how gender played a role in their memorization experience. As a result, there are groupings by gender for each quantitative finding, and, as applicable, groupings by other demographics and categories are mentioned for relevant findings.

The qualitative responses from the diaries and interviews were used to explore answers to the second research questions and determine the benefits and challenges of using both memorization formats. For the 721 entries received from the daily diary logs, the data was first cleansed to filter out all duplicate entries (138), entries of participants who did not complete the study (59), and entries where participants said they did not memorize anything that day (24), resulting in a total of 500 entries to include as part of the primary data analysis. The entries of participants who did not complete the study (59) were stored separately for secondary data analysis on attrition rates. For the 500 filtered diary logs and subsequent 23 interviews, a first round of inductive coding using the in vivo and axial coding methods was conducted in which select phrases from the entries were extracted and grouped into five main categories. Following the in vivo and axial coding, a Likert scale was used to categorize the passages related to memorization formats to analyze sentiment towards the physical and digital methods. Selective coding was utilized to identify key themes of beliefs, practices, benefits and challenges regarding memorization formats.

The qualitative responses were also used to answer the third research question of determining what opportunities exist to enhance the memorization formats. The design recommendations are based on direct feedback provided by participants from the diary logs and post-study interviews and by examining pain points mentioned by participants and seeing if there are any additional ideas to address those issues. The recommendations provide direction on where to conduct further analysis, user research and validation to plan and prioritize future enhancements.

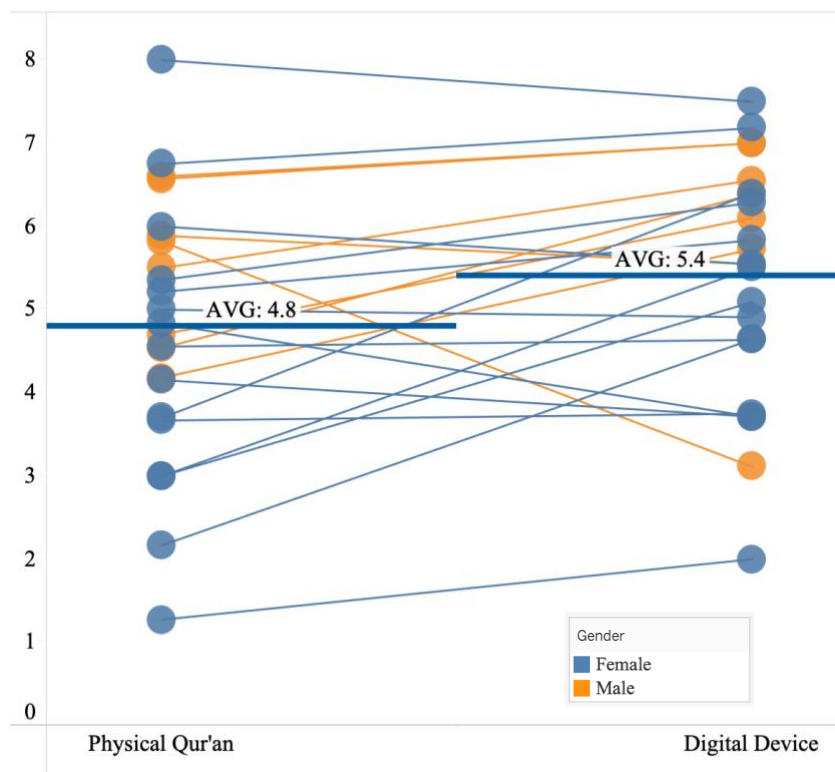
Chapter 4: Results & Findings

4.1. Comparison of Memorization Formats

4.1.1. Level of Difficulty

Participants reported a higher average level of difficulty for the digital device on a scale of 1-10 (1 = Very Easy, 10 = Very Difficult), with a mean of 5.4 versus 4.8 for the physical device. The difference was statistically significant with a p-value of 0.011. The difference was also statistically significant when comparing the level of difficulty of each format for women ($p = 0.025$) but was insignificant when comparing for men ($p = 0.106, ns$).

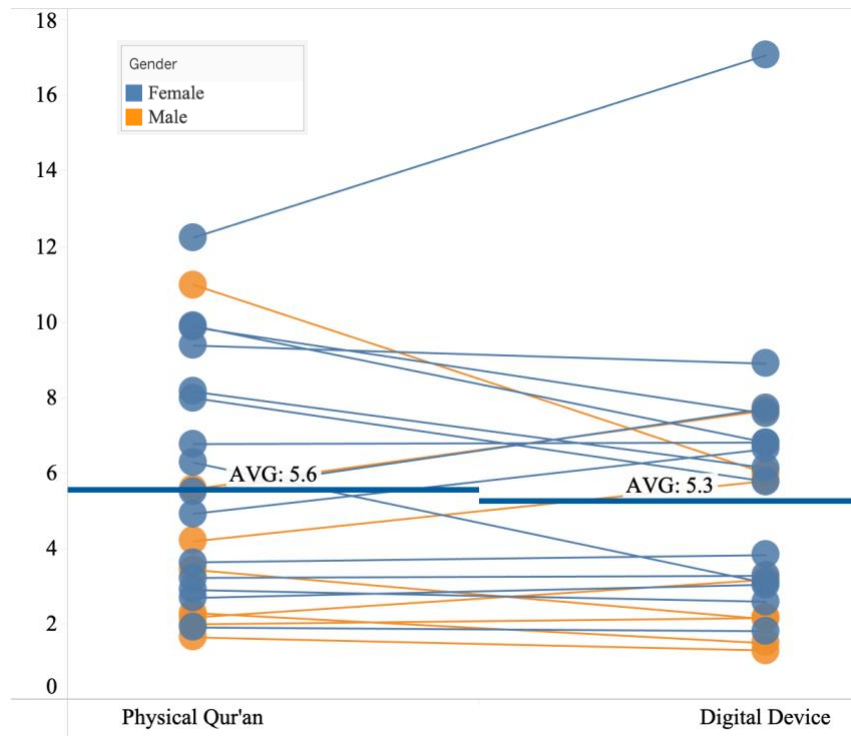
Figure 4.1 – The reported average levels of difficulty by participant on a scale of 1-10 (1 = Very Easy, 10 = Very Difficult). The lines connecting the points of both sides depict the relationship between levels of difficulty by format and are color-coded by gender. The average level of difficulty per format for all participants is also shown.



4.1.2. Amount Memorized

There was no statistically significant difference between lines memorized per format found when looking at all participants ($p = 0.52$, *ns*) or specific gender demographics. The average lines memorized for the digital and physical formats were relatively the same at 5.6 lines memorized for physical Qur'ans and 5.3 lines memorized for digital devices. Even though participants reported a higher level of difficulty with digital formats, as discussed in Section 4.1.1, this did not translate into output differences in terms of the number of lines memorized from the Qur'an per day.

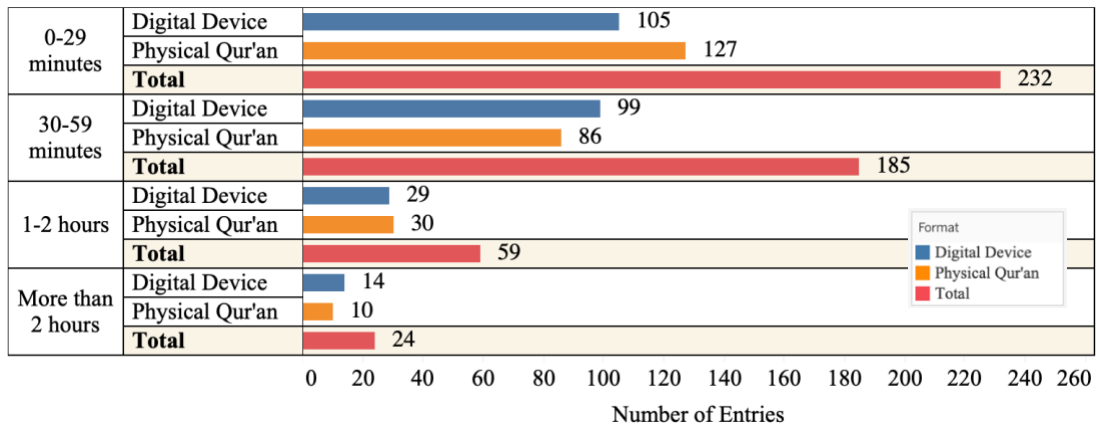
Figure 4.2 – The reported average amount of lines memorized by participant. The lines connecting the points of both sides depict the relationship between amounts memorized by format for each participant and are color-coded by gender. The chart also shows the average amount of lines memorized per format for all participants.



4.1.3. Time Spent on Memorization

When looking at all participants, the most common amount of time spent memorizing per format was 0-29 minutes (see Figure 4.3 for details). The median time spent memorizing on a digital device per day was 30-59 minutes, while the median memorization time spent on a physical Qur'an was 0-29 minutes.

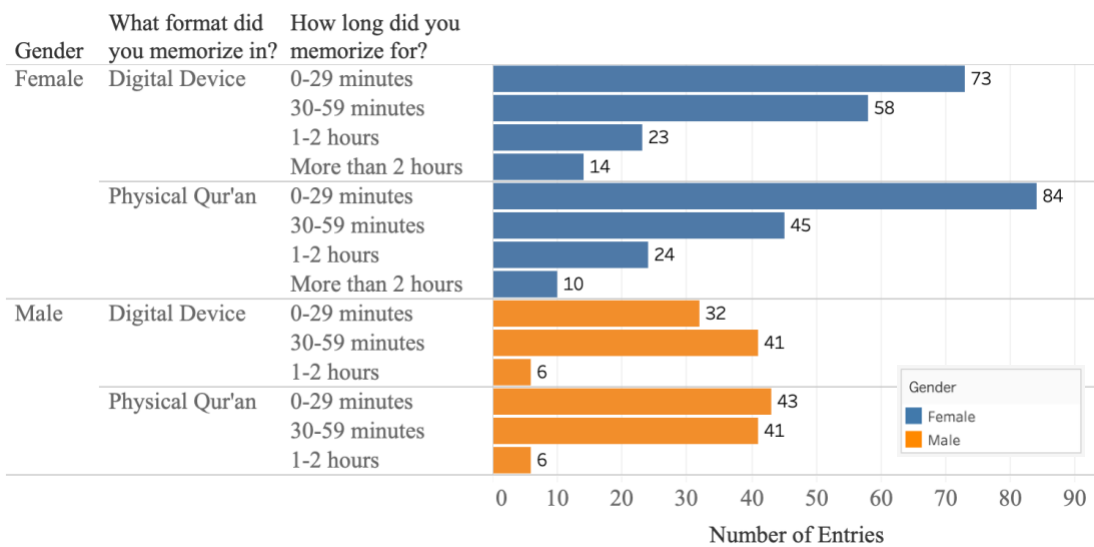
Figure 4.3 – Participants' reported time spent memorizing per session, grouped by format. The results show the mode was the same for both formats, though the variance between the two most common time sessions for the digital device was relatively small. The modest variance led to comparing the median of time spent memorizing on both formats, which proved to be higher for the digital device.



In terms of gender (see Figure 4.4), female participants most commonly spent 0-29 minutes per session on both formats. Male participants reported similar figures for physical Qur'ans but spent 30-59 minutes most commonly for digital devices. In some respects, this can be seen to correlate with the reported levels of difficulty discussed earlier in Section 4.1.1., as male participants did not have a statistically significant difference in the level of difficulty and are now seen to be spending more time on average with digital devices. On the other hand, female participants reported a higher level of difficulty and spent less time on digital devices than male

participants. These findings will require further study to understand why these differences exist between genders and determine how the digital device experience can be enhanced for female participants.

Figure 4.4 - Participants' reported time spent memorizing per session, grouped by memorization format and gender. The results show female participants mostly memorized for 0-29 minutes for both formats, while male participants mostly memorized for 0-29 minutes for the physical Qur'an, but 30-59 minutes when memorizing using digital devices.

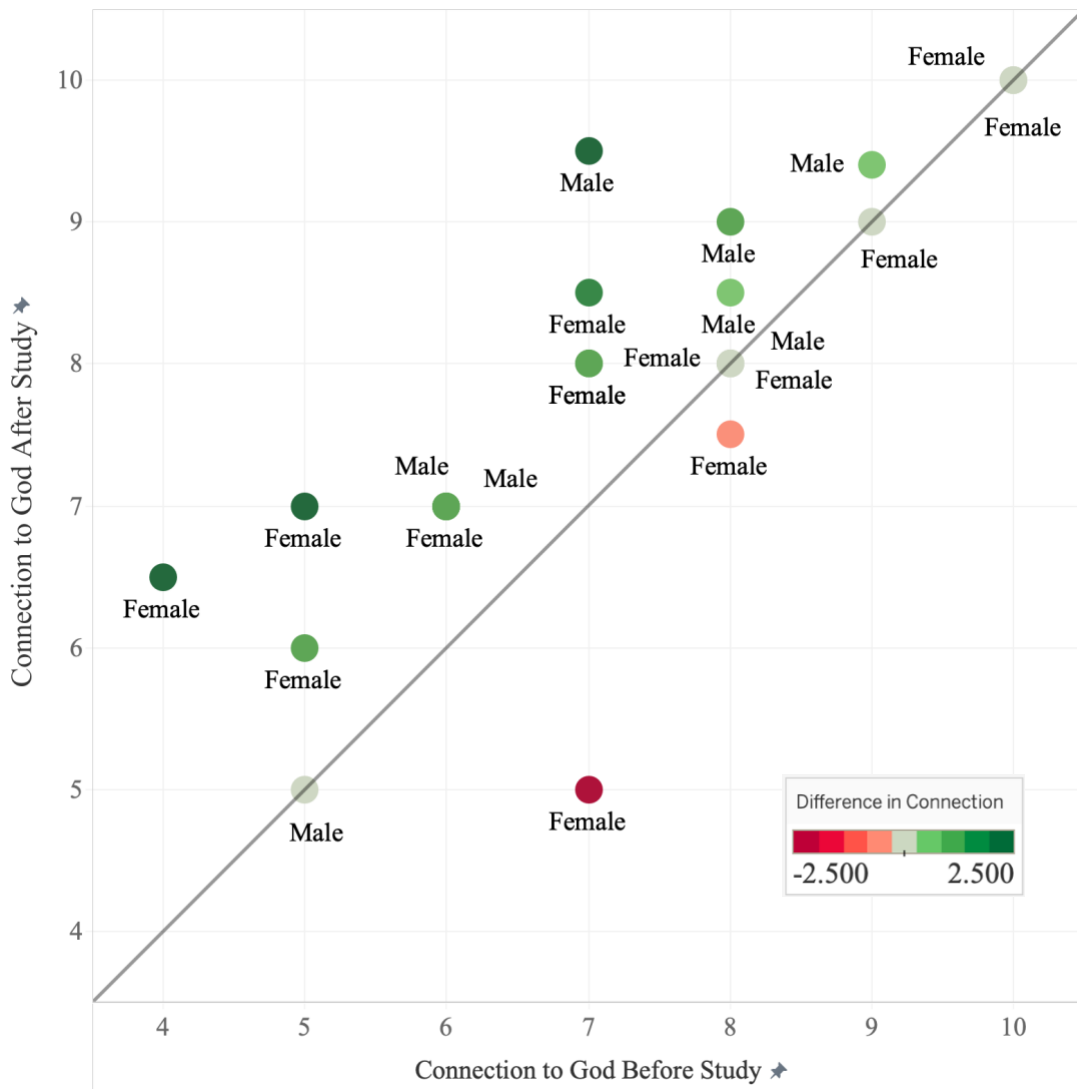


4.1.4. Connection to God

When looking at the self-attested connection to God reported by all participants on a scale of 0-10 (0 = No Connection at All, 10 = Very High Connection), there is a statistically significant difference in feeling closer to God following the memorization study ($p = 0.008$). In terms of gender, the difference holds for men ($p = 0.0026$) but not for women ($p = 0.101, ns$). The gender disparity is visually represented in Figure 4.5, where female participants comprise most of those who appear on or below the diagonal line that denotes a lack of variance from study start to end. Additionally, to see if there was a correlation to memorization formats, participants who memorized

primarily with a physical Qur'an were compared with participants who memorized with both formats equally and primarily with digital devices. The results showed that the former category of participants did not report a statistically significant difference in their connection to God ($p = 0.058$, *ns*), while the latter category did ($p = 0.035$).

Figure 4.5 – Participants' reported sense of connection to God on a scale of 0-10 (0 = No Connection at All, 10 = Very High Connection) before and after the study. The diagonal line represents a lack of variance over time, while the colors indicate how much of a positive, neutral, or negative change was reported.



It is important to note that a participant's rating of their sense of connection to God involves many more variables than the format they memorize with and goes beyond the purview of this study. Hence, the conclusion here is not to say that a specific memorization format is a sole reason behind a change in their self-attested connection to God, but that certain factors behind this study, such as spending more time during this period to read religious scripture to meet the study requirements, could have been a factor in impacting a participant's connection to God.

4.1.5. Sentiment Analysis

Post-Study Reported Sentiments

During the post-study interview, participants were asked about their memorization experience using the digital and physical formats. 91% of participants (n=21), including several who indicated before the study that they generally memorize with a digital device, reported that their memorization experience with a physical Qur'an was better than when they had memorized with a digital device. The difference was statistically significant when testing the null hypothesis that the experience would be the same for all participants ($p < 0.001$) and when examining the responses of male participants ($p = 0.010$) and female participants ($p = 0.001$). The findings are visually represented in Figure 4.6, which shows how participants rated their memorization experiences per format on a scale of 1-5 (1 = Strongly Dislike, 5 = Strongly Like), and in Figure 4.7, which depicts the average variance of ratings when looking at gender and age demographics.

Figure 4.6 – Ratings of memorization experience per format on a scale of 1 to 5 (1 = Strongly Dislike, 5 = Strongly Like). The chart shows that participants’ memorization experience of the physical Qur’an was largely rated at 4 and 5, while the digital format was rated lower at mainly 3 and 4.

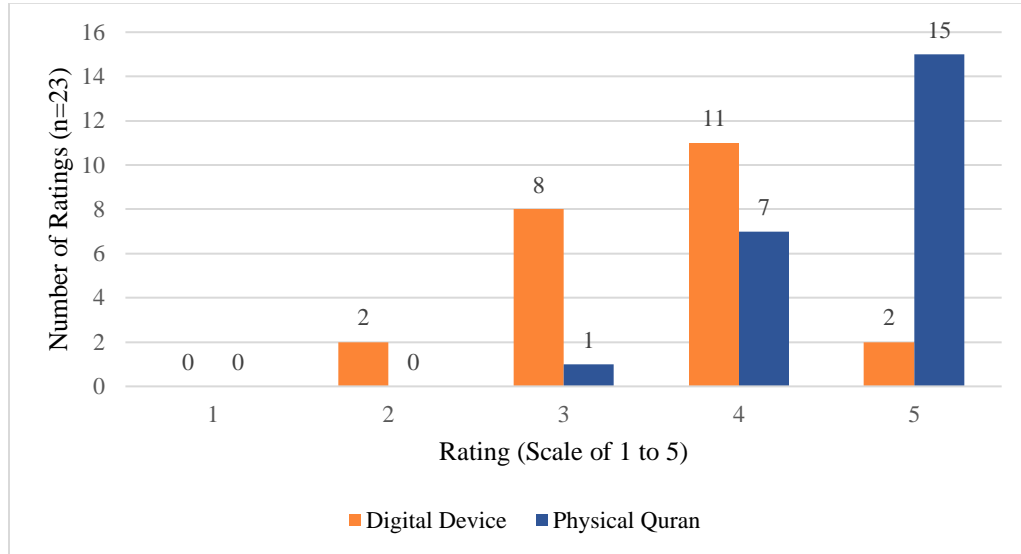
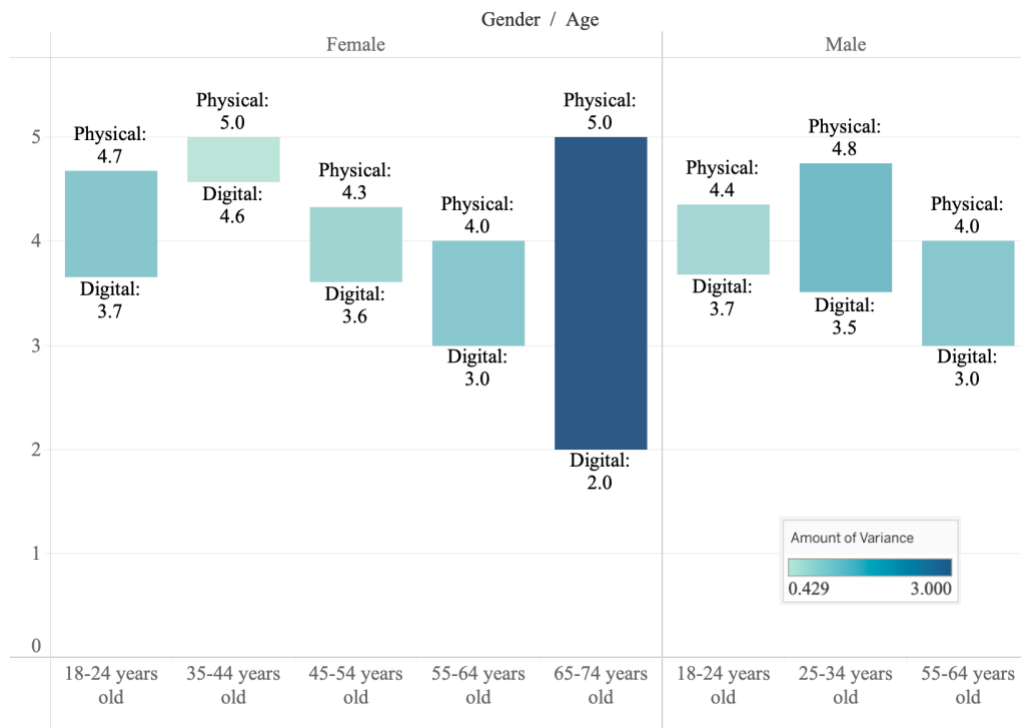


Figure 4.7 – The variance of participants’ average ratings of memorization experiences per format grouped by gender and age on a scale of 1 to 5 (1 = Strongly Dislike, 5 = Strongly Like). The colors denote the severity of variance.



Manual Tagging of Diary Sentiments

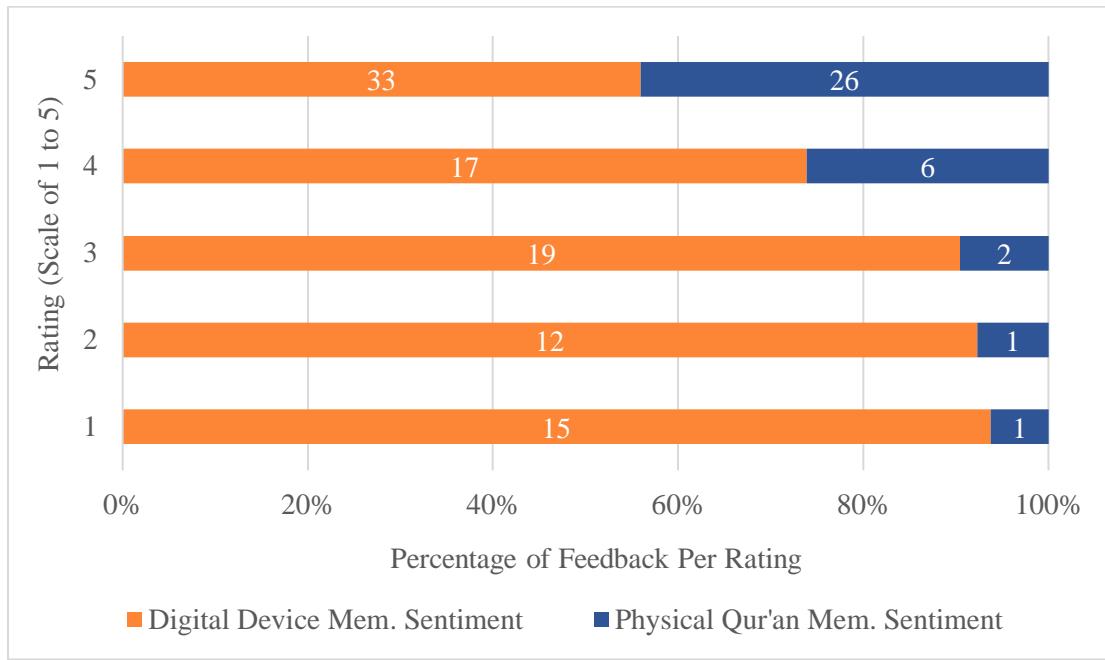
In addition to asking participants about how they would rate their experiences using both formats, the freeform comments in the diary logs of all participants were analyzed to see if there was mention of their sentiment towards memorizing the Qur'an on digital and physical formats. The analysis was conducted as a secondary check to compare participants' sentiments during the study against sentiments they shared during the post-study interviews to see if the metrics gave similar results.

Ninety-six entries speaking about the digital device memorization and thirty-six entries speaking about memorizing from a physical Qur'an were identified from the diary logs. Following that, the sentiments were manually tagged using a rating system modified from the Likert scale (see Table 4.1 for details). The analysis came to show congruous results to the post-study reported sentiments (see Figure 4.8 for details). The average sentiment towards physical Qur'an memorization gleaned from manual tagging the diary logs was 4.53 out of 5, while participants reported an average sentiment of 4.59 out of 5 during the interviews. As for digital device memorization, the manual tagging showed the average sentiment to be 3.43 out of 5, while the interviews showed an average sentiment of 3.57 out of 5.

Table 4.1 - Codebook for manually tagging sentiments from diary responses

Rating	Description
1	Only negative sentiments were stated about the format
2	Mainly negative sentiments, but some positive elements were stated
3	Split of negative and positive sentiments; neutral
4	Mainly positive sentiments, but some negative elements were stated
5	Only positive sentiments were stated about the format

Figure 4.8 – Participants’ sentiments towards memorization formats from manual tagging on a scale of 1-5 (1 = Only Negative Sentiments, 5 = Only Positive Sentiments). The chart shows that more feedback was given for the digital experience overall and that a diverse array of ratings was given for digital devices while the physical Qur’an was mainly given positive ratings.



4.2. Benefits and Challenges of Memorization Formats

To answer the second research question and determine the benefits and challenges experienced by memorizers of the Qur’an when memorizing on traditional and digital formats, the participants were asked to provide feedback on their experiences as freeform responses on the diary logs and the post-study interviews. Following the compilation of these responses, a first cycle of qualitative coding to highlight key phrases using the in vivo coding method was utilized. Next, axial coding was conducted wherein the key phrases were grouped into five distinct categories that emerged as the coding was reviewed to draw connections and organized accordingly (see Figure 4.9 for an example of all categories appearing in one diary entry quote and Table 4.3 for an explanation of the five categories).

The diary logs and categories reflect a wide-spanning array of topics that the participants wrote and spoke about, including the context, content and process of their memorization, moods and feelings, personal struggles and external distractions, and the impacts of using an assigned format on their memorization. The feedback received was representative of diary study responses and expected since the open-ended questions allowed for freeform reflections and enabled the participants to reflect on their experiences holistically instead of only considering the impact of digital and physical formats on their memorization.

To keep the study within scope on the researcher's side, the next cycle of qualitative analysis focused on selective coding of the words and phrases found in the category describing the impact of digital and physical formats since that is the study's objective. The responses in the other categories were consulted and kept in mind when analyzing and writing the results and findings. However, they were not further coded during the second cycle since they were not directly related to the category that captured all pertinent reflections on the formats of memorization.

Figure 4.9 – A diary entry quote that includes an example of each category

	“I started to recite the previous verses that I memorized yesterday and kept on adding the new verse each time. [Thanks to God] I was energized and had a better performance. I sat in a quiet area at home and recited with my usual loud voice. Using the physical copy of Quran, I felt a good connection in memorizing the verses. It's much easier to deal with. [Chapter] Naba (14 verses) memorized.”
TECHNIQUE	new verse each time.
MOOD & EASE	energized and had a better performance.
CONTEXT	a quiet area at home and recited with my usual loud voice.
FORMAT	Using the physical copy of Quran,
CONTENT	[Chapter] Naba (14 verses) memorized.”

Table 4.2 – Five categories and descriptions that emerged from axial coding. While all categories were consulted and used to draw insights, the main category coded and analyzed further was the ‘Format: impact of digital & physical’ category since that is the focus of this research study.

Category	Description	Count
Mood & ease	Level of energy, mood, engagement, excitement, and ease of memorization	222
Format: impact of digital & physical	Benefits, challenges, and reflections of using the given method of memorization	136
Context: environment & external distractions	Time or place of memorization and distractions unrelated to format (e.g., family, work, chores)	107
Technique	Procedures, methods, and tools used during the process of memorization	105
Content: description & reflections	Descriptions of the passages memorized and related reflections and thoughts	62
Total		632

4.2.1. Digital Devices

The results from the focused coding of the words and key phrases associated with the impact of physical and digital formats uncovered eight primary benefits and eleven significant challenges of utilizing a digital device for Qur’anic memorization (see Table 3.1 for details). The benefits were focused on the variety of functionality afforded inherently by a digital device as well as the Qur’an memorization apps available on it. The challenges covered missing features that were available to participants when they memorized on a physical Qur’an, issues from using a digital device for too long and experiential difficulties such as a lack of affinity and sense of personal connection to digital devices.

Table 4.3 – Participants’ reported benefits and challenges of memorizing the Qur’an utilizing digital devices, including how often it was mentioned as feedback

Category	Sub-Category	Count
Digital Device Benefits	Translation Feature	10
	Convenience	9
	Recitation Audio Feature	8
	Brightness Feature	5
	Zoom Feature	3
	Availability of Features	2
	Ability to Multitask	2
	Inspirational Videos	1
Subtotal		40
Digital Device Challenges	Distractions & Notifications	28
	Lack of Annotation Features	12
	Page Visualization	9
	Difficult to Focus	7
	Eye Strain	6
	Format Mismatch	4
	Lacking Affinity & Connection	4
	Page Comparison	2
	Lack of Color	2
	Finding a Suitable App	1
Subtotal		75
Total		115

Benefits of Memorizing with a Digital Device

While the experience of using digital devices for Qur’an memorization was rated lower than the usage of physical Qur’ans across all demographics, some participants spoke about how pleasantly surprised they were to find them a viable method of memorization once they “got the hang of using a digital device to memorize the Qur’an” and that the experience “changed my perspective on using a digital device.” The phenomenon of becoming comfortable with a digital device was seen when

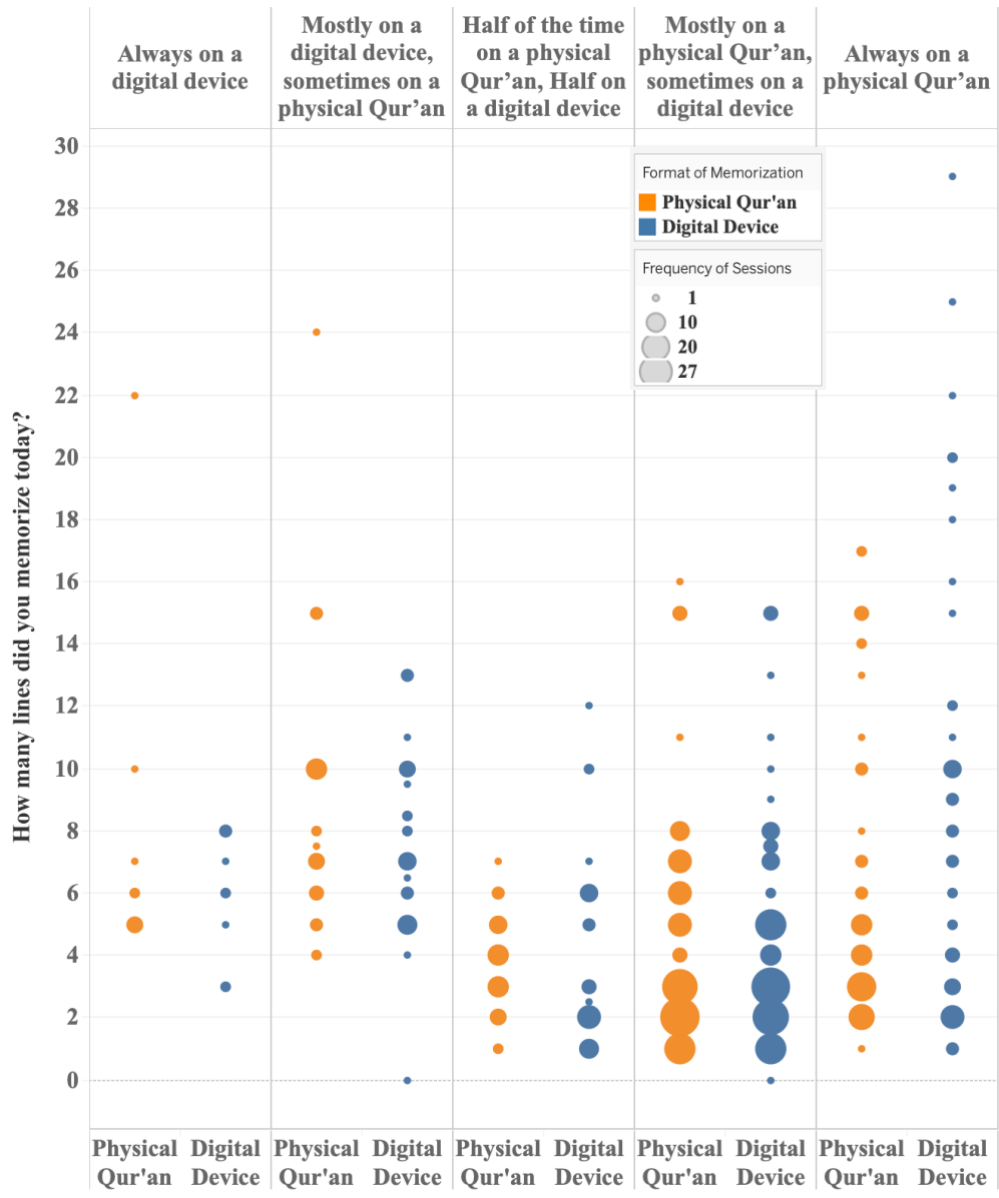
visually exploring the number of Qur'anic lines memorized by participants, in that participants who said they always memorized using a physical Qur'an before the study memorized more significant amounts using a digital device when compared to others (see Figure 4.10). Several participants echoed a preconceived bias that digital devices would not be well suited for memorization. One participant shared,

Since I started on the first day, I was against using a digital device. Negative about it. I thought like it doesn't give you that feeling that one gets one memorizing from a physical Quran. However, I myself was surprised to see a different result. At last, I'm very pleased that I've used this method. I do feel like it helped me to memorize more and be active as well.

Towards the end of their study period memorizing with a digital device, participants remarked that they “found the digital very helpful,” especially when they began to utilize airplane mode on their phones to avoid distractions while memorizing and came to learn about more of the features available on memorization apps. The feature most commonly cited was being able to understand the meaning, typically done through tapping verses on the screen and seeing the translation appear, which helped many learn the underlying meanings of the text and memorize more effectively. The second most commonly cited feature was being able to listen to professional reciters on a memorization app or on a streaming service such as YouTube, which helped them “to hear God’s words,” memorize through auditory means and learn “proper pronunciation” in order to recite and memorize the content correctly. A few participants also shared that they appreciated the ability to zoom as needed in order to

see the content better and liked that the brightness of their digital device screens helped them to recite comfortably without needing them to move or sit at an angle to receive appropriate natural or room lighting when reading the Qur'an.

Figure 4.10 - Number of Qur'anic lines memorized by participants in each session, segmented by how they would typically memorize before beginning the study. Larger circles denote a higher frequency of sessions of the corresponding number of lines being memorized. The chart shows that some participants who had always memorized on a physical Qur'an memorized more lines when using digital devices.



Convenience was discussed at length by participants, who said it allowed them to memorize during breaks at school or work, to multitask while working on other responsibilities such as feeding their baby, driving to work, or taking care of family members. Some found memorizing on a digital device “liberating,” saying they appreciated it did not require making an ablution to read from a device and that it was “easy to find, easy to get started.” For the female participants who believed that a menstruating woman could not hold a physical Qur’an, they found memorizing on a digital device to be indispensable during this time, sharing that it helped them keep a connection to the scripture and avoid needing to spend days “ramping down and up” their memorization routines every time their period started and ended.

Participants also shared examples of how they utilized digital devices for Qur’an memorization. A few participants spoke about websites such as QuranFlash.com (see Figure 4.11) that replicated the look of a physical Qur’an in having two pages side-by-side and allows users to highlight, leave notes, listen to different reciters, and pick from a selection of translation options and a range of Arabic scripts. Others employed Qur’an memorization apps such as Tarteel (see Figure 4.12), which utilizes artificial intelligence to recognize what a user is reciting, display verses on the screen only once it is recited, and let the user run voice-enabled searches. One enterprising participant wanted to learn the Qur’an using visual imagery while memorizing from a digital device but could not find something suitable for his needs, so he ended up building a personal SharePoint site (see Figure 4.13) where he added an image, Arabic text, and English translation and transliteration for every verse he memorized.

Figure 4.11 – QuranFlash.com [1], a browser-based Qur'an learning software that allows a user to read digitized versions of the Qur'an in different scripts, highlight verses in varying colors, leave notes, view translations and commentaries in multiple languages, listen to a selection of reciters, and zoom in and out

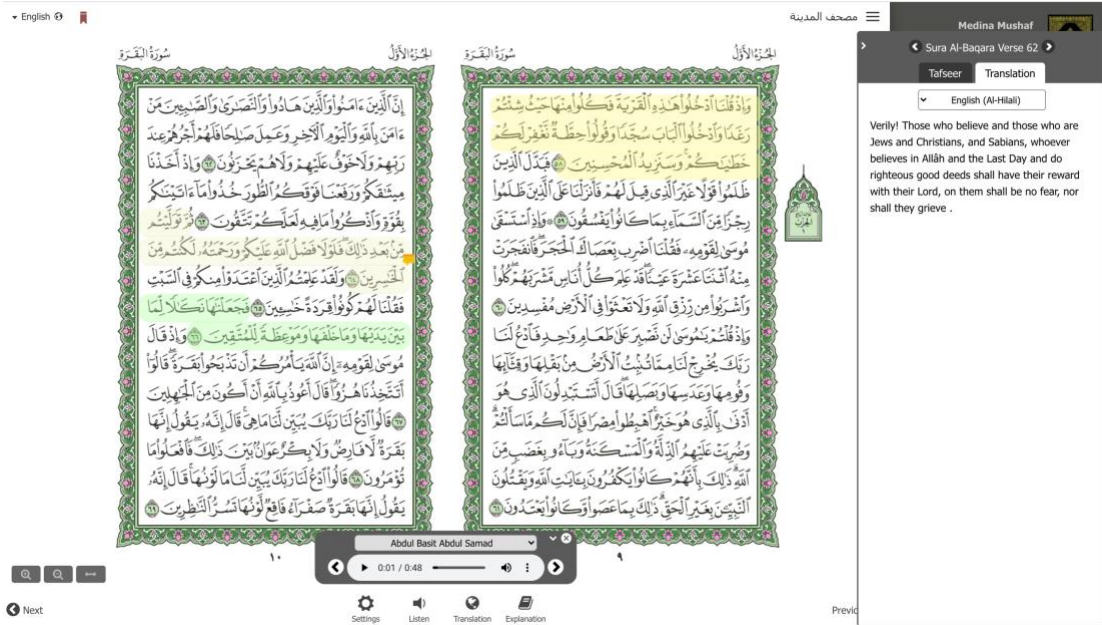


Figure 4.12 – Tarteel [2], a Quran memorization phone app that assists users to memorize through AI methods that unveil words only as they are recited. The voice recognition technology gets better with every person who records their recitation.

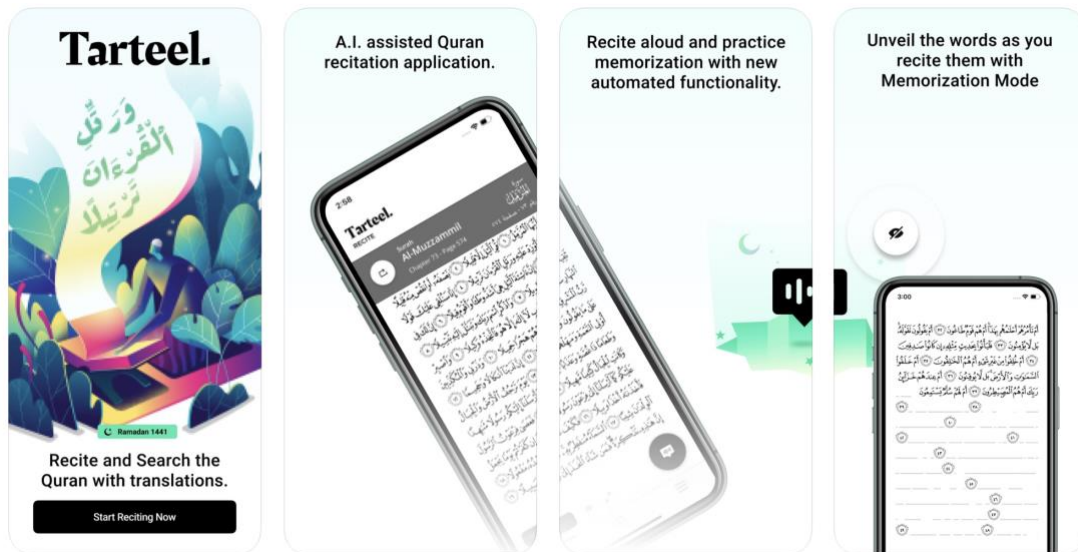
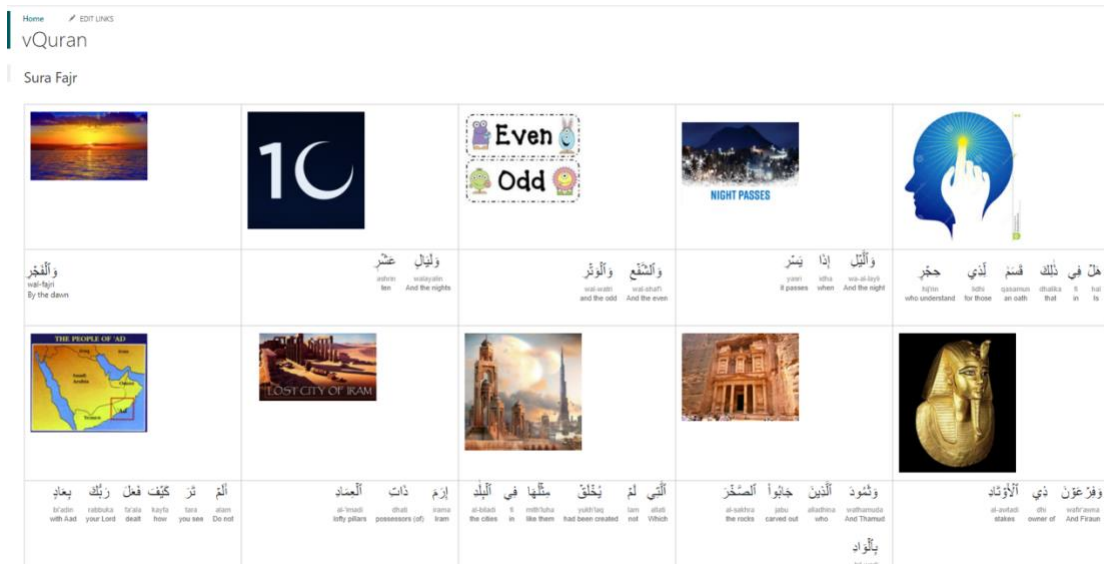


Figure 4.13 - Site built on Microsoft SharePoint by a study participant that utilizes handpicked imagery corresponding to the meaning, translation, and transliteration in order to assist with memorization and retention [used with permission]



Challenges of Memorizing with a Digital Device

While participants appreciated many of the features afforded by a digital device, they found that the experience did not match that of memorizing with a physical Qur'an. A commonly mentioned challenge with digital devices, specifically for mobile ones, was that they were distracting due to “notifications that kept on appearing,” the ease of switching apps, and since participants were used to utilizing a digital device for multiple purposes. Compared to using a physical Qur'an, which is just used for reading, “seeing the notifications light or sound go off” or “seeing something while memorizing that takes your attention” proved to make it difficult for participants to stay focused on the cognitively heavy task of memorization.

Participants also frequently stated that they found it challenging not to have the ability to annotate and mark mistakes on digital devices. Marking mistakes helps

memorizers of the Qur'an who are attempting to commit the exact word-for-word content of the pages to memory and need to know where they commonly make mistakes in order to avoid making them in the future. Participants shared that being able to annotate and write assists with haptic memory, leading to longer retention of the content, and that annotating allows them to personalize their Qur'an and thereby feel closer to it. Interestingly, participants reported they do not trust the current annotation and note-taking functionality that is currently found on memorization apps, which generally allows for highlighting and adding notes of complete verses instead of specific words, citing that if a page is refreshed or an app is updated or installed, the notes they wrote would disappear. A participant elaborated,

I also write in my physical Qur'an, and I know if I write in it, it will always be there. If I write on my digital app, it wouldn't stay, and it would be lost at some time in the digital realm. If I write on the physical, it'd be with me for the rest of my life.

Participants spoke about visual and cognitive-related challenges related to their experiences of memorizing the Qur'an on a digital device. Several memorizers (n = 9) shared that they "usually use the placement on the page to help [with] memorization, but that's not possible on an app." In essence, they draw a visual picture of the page in their minds, which helps them remember where a verse is located and what verses are accordingly coming next in order. With a digital device, particularly when reading on a version that continually scrolls or in a version that does not match the layout of a physical Qur'an, those "visual landmarks" are not seen. A participant who ended up

leaving the study due to difficulties with memorizing on the digital device said, “I can't conjure an image of the page in my mind...Getting harder and I'm losing motivation to memorize. I can't recall my last memorization and I'm struggling.”

Participants also shared that they found it more challenging to focus, with some saying they noticed excessive eye strain from staring at the same page for so long to memorize. A participant tried using blue light glasses to remedy the problem but did not find that to help. She ended up withdrawing from the program, saying, “I can't stare at my phone or computer for too long especially while reading a text. I'm really sorry...” Another participant shared that “my eyes would just blur the words and [verses]” and attributed this to using a digital device and because her memorization app displayed the verses in black and white instead of the color-coded pages that can be found on many physical Qur'ans and denote guidelines of oral recitation.

Participants also spoke about not being able to compare multiple pages easily, mainly when memorizing similar-sounding verses. Others mentioned they felt overwhelmed by the number of options available to them on the app and wished for a “Reading Mode” that would only show the Qur'anic text.

Lastly, a common theme that emerged from challenges reported by participants was the lack of feeling the same level of affinity and connection that they felt with a physical Qur'an. Participants shared that “it felt more of like sitting with an old friend” with a physical Qur'an and that with a digital device, “it was easier to get done but [with] less regard. [The] phone is more portable but made me lazier.”

Another said, “The digital feels very convenient and effortless, but you don’t feel the same as a book...The book feels more real sacred.” Even for participants that memorized considerable amounts using a digital device, one shared, “I was surprised I memorized more on a digital device, but I didn’t enjoy it as much.” Another attributed this lack of enjoyment to the “utilitarian nature” of digital apps, saying that they found it to be a “very useful and convenient tool” but that it just did not replicate the “missing feeling of holding a Qur’an” in their hand.

4.2.2. Physical Qur’ans

In terms of benefits and challenges mentioned for memorizing with a physical Qur’an, there were six key benefits and four main challenges that were identified from the focused coding of keywords and phrases related to memorization formats, with many essentially being an inverse of what was mentioned as benefits and challenges for digital devices (see Table 4.4 for details).

Table 4.4 – Participants’ reported benefits and challenges of memorizing the Qur’an utilizing a physical format, including how often it was mentioned as feedback

Category	Sub-Category	Count
Physical Qur’an Benefits	Affinity & Connection	20
	Easy to Focus	11
	Page Placement	6
	Ability to Annotate	5
	Translation Feature	2
	Color-Coded	2
Subtotal		56
Physical Qur’an Challenges	Lighting Issues	4
	Lack of Translation	3

Inconvenience	3
Lack of Audio	2
Subtotal	12
Total	68

Benefits of Memorizing with a Physical Qur'an

Participants most commonly spoke about the affinity and connection they felt with a physical Qur'an, sharing that "it helped me relax and feel peaceful during my memorization, especially in the morning when I really dislike being on any form of technology," it gave them the "ability to trace the line with your finger and have the page placement in your mind," and "it made me connect more." Participants offered that they were able to personalize their Qur'an to make it feel like theirs, that they could tell their progress on how much they memorized from looking at the side of their Qur'an since those pages were more worn out, and that "just flipping through the pages has an effect on you." When participants who primarily memorized using a physical Qur'an began the latter half of the diary study and were allowed to use a physical Qur'an to memorize, several entries spoke to how relieved they were to return to the book format of the scripture. One participant said, "Honestly, I missed using a physical Quran and it was so much easier with this, at least it felt easier."

Similar to feedback given for digital devices, participants spoke about annotating, visualizing the pages of a Qur'an, and the ability to focus, but as benefits instead of challenges on a physical Qur'an. Participants shared the format "gives a sense of photographic memory," "helps me visualize the pages and where the lines are on them a lot better," and that "you can look at the whole page and plug in the meanings,

while on digital, everything is fluid.” Participants shared that the obligation to perform ablution and sit down with the Qur’an in fact helped them focus more and signified to family members that they were occupied, making it easier to concentrate.

Some participants shared favorite versions of a physical Qur’an they used for memorizing, including a Qur’an printed in Malaysia (see Figure 4.14) that had word-for-word translations underneath each Arabic line, complete translations on the side, and color-coded rules of recitation. Others shared ways they personalized their Qur’ans, such as brightly embroidering their names in Arabic calligraphy on their books (see Figure 4.15) or with custom Qur’an bookmarks (see Figure 4.16).

Figure 4.14 - Example of a color-coded physical Qur'an with translation underneath the Arabic in a word-for-word format and on the sides in a narrative form [74]



Figure 4.15 – A customized Qur’an cover available to personalize and purchase online that includes the name of the memorizer and a custom color palette. [54]



Figure 4.16 - Example of custom bookmarks made for Qur’an reciting. Students will often include their names, motivational quotes and favored verses. [12]



Challenges of Memorizing with a Physical Qur'an

Participants most commonly spoke about inconveniences they faced when memorizing with a physical Qur'an. They discussed the physical Qur'an required making ablution before touching it and that it cannot be carried everywhere easily, especially when using the restrooms or when traveling as the physical Qur'an may not be able to be kept in an elevated and clean place as is commonly done with the religious scripture. One participant shared that lighting was a severe issue that only became apparent during the study, "I really need an overhead light upstairs because the lighting situation is starting to bother me. Mind you I'm only noticing lighting after the digital format memorization phase."

Participants spoke about how much they missed the features available on digital devices to listen to audio and quickly access translations and commentary. Physical Qur'ans with physical translations are typically heavier, so participants mentioned they would only use the translation versions at home and not take it to work or school with them. Participants spoke about how using a physical Qur'an after using a digital device for two weeks "felt more of a task" in that it required much preparation and that using a physical Qur'an meant having "*adab* (etiquette) with it, always having to make *wudu* (ablution), and seeing it as *ibadah* (worship)" [parentheses added by researcher]. Some female participants shared that they were not able to use the physical Qur'an when menstruating as a result of their religious beliefs, while others said they used methods to circumvent touching it with their bare hands, such as using gloves or a pencil to turn the pages, which they believed to be religiously allowed.

4.3. Enhancing the Memorization Experience

To answer the third research question and generate solutions on how the tools and processes for memorizing the Qur'an can be enhanced for a better user experience using either format, participants were asked during the post-study interview what feedback they would provide to app developers or book publishers creating Qur'an memorization-centric products. The participants' challenges of memorizing with the varying formats, as previously discussed, were also examined to see if any features should be suggested to address their pain points. The resulting solutions were categorized into themes grouped by format that can provide strategic and design direction on how the current tools and processes for Qur'an memorization could be further enhanced for users. It should be noted that the design and implementation of these features will require further user research and usability testing in order to validate these recommendations and develop better user-centered interfaces.

4.3.1. Enhancing the Digital Experience

Encouraging Mindfulness

With most participants sharing that the most significant challenge they faced with digital device memorization was the number of distractions and notifications encountered, it follows that a critical element of feedback was to see if distractions could be removed and determine if there are ways to encourage mindfulness of the memorization content and process on digital apps and software. Participants spoke about wanting a 'reading mode' similar to a 'do not disturb' mode that would be enabled when they used the app to remove all distractions and requested

memorization apps that did not have built-in ads. Following the study, several participants said they enjoyed the experience of journaling their experience, wanted to continue writing their thoughts on the app, and access the notes at a later stage for them to review at their discretion. Participants also brought up that they would benefit from tips provided as textual or video content that would help them be more mindful and better equipped to memorize effectively.

Maintaining Motivation

Participants shared that the journey of memorizing the Qur'an in its entirety is a long one that can take several years, and so they would like the digital experience to reflect what they have accomplished and what they have yet to do. A primary recommendation from participants was the ability to set memorization goals (e.g., memorize a specific set of pages) and see how much they accomplished towards that goal. Several said it would be convenient to set reminders or calendar events at regularly scheduled intervals to remind them to recite. If they missed reciting for a few days, the app could encourage and inspire them to continue their memorization.

During the post-study interview, some participants shared that they appreciated the analytics view of their memorization outcomes and practices they were provided and saw in their personalized study reports and wished this was something that could automatically be captured for them that they could reference to see how they have been performing, allow them to reflect on how to improve their habits and motivate them to continue memorizing.

Interacting with the Content

Participants wanted to interact with the content they were memorizing beyond just the capacity to access and view it on their screens. The most commonly requested feature in this regard was the ability to mark and annotate specific words on a page (e.g., through highlighting, underlining, or circling) for various reasons, including to annotate previous mistakes they made, verbiage that was complex or included similar wording to another passage, or essential topics they wanted to reference in the future. Currently, Qur'an memorization apps only allow the ability to highlight a whole verse, which makes it difficult for participants to know in one glance which word or set of words they were looking for specifically. The apps also do not offer the feature to save the user's annotations, so incorporating user profiles and cloud backup solutions could prove to be beneficial for users.

Participants provided feedback that they wanted the ability to tap on words and see options to view word-for-word English translation, links to scholarly commentary that could be in the form of text, audio, or video, see a list of all of the passages where that specific word appears in the Qur'an, and listen to the audio recitation of that word or set of words. Essentially, similar to the annotation feature requested, participants were interested in interacting with specific words instead of only having options of interacting with an entire verse, which could contain dozens of words in many instances. One participant shared, "I sometimes listen to a verse over and over on a loop to help me memorize it. When I want to learn one line at a time, it would be helpful to select only that line to listen to."

Several participants shared that they enjoyed self-learning and wished for options that would enable them to learn on their own more effectively. They shared that it would be helpful to recite to the app and receive automated feedback letting them know if they made any mistakes in their memorization or pronunciation. They wanted the ability to improve their recitation with online modules and lessons they could access on their own time. Some brought up that reviewing their memorized content—an act performed regularly by memorizers of Qur'an over the course of their lifetime in order to retain what they had memorized—can be a tricky part of the process, and desired more features to help them with reviewing, such as providing online quizzes and flashcards to test their memory. Some wanted to have the ability to switch between different Arabic scripts and translation options instead of needing to install different apps. A few brought up they wanted to view visual imagery related to the content, saying they were audiovisual learners, and that the imagery would help them connect the meanings to the words. Others said that their self-learning on a digital device would be enhanced if they could search and find passages more easily through better voice-enabled and text search functionality than what was currently available to them on the digital devices.

Participants also spoke about affordances they had become accustomed to finding on a physical Qur'an and wished to have similar features on their digital devices. They spoke about wanting the text to be color-coded based on recitation rules or linking themes together, as is commonly found on physical Qur'ans. Participants said that the requested inclusion of color instead of seeing all verses in black-and-white was as

much about learning the rules and underlying content as it was about making it easier and more visually appealing for them to look at the screen. Along the same vein of feedback, some said they wanted to view pages in neutral colors instead of only in white or black backgrounds to lessen eye strain. A few went even further to suggest ways the digital device could mimic a physical Qur'an more, suggesting that there should be tactile interactions built into the apps to feel like one is interacting with a physical book, or saying that they wanted to see visual indicators on the right or left side of a page to denote what side of a physical Qur'an that page would be on.

Interacting with Others

“If I can use Fitbit or Strava to track my fitness goals and compete with others, why can't I use similar functionality on my app for memorization?” asked one participant. Some participants said that they would like the ability to add friends, family, and contacts to their Qur'an apps and see how much others had read and memorized. They shared that it would motivate them to make a shared goal with their contacts and compete with them to see who completed the goal first or who had the strongest memorization at the end of the challenge period. A few said that they would like to see a global leaderboard on their apps to see how well they are performing relative to others and be encouraged to know that others were memorizing. Some wanted to find and connect with others that were memorizing similar content or comparable amounts to them to encourage one another to memorize. Others wanted to connect specifically with coaches and tutors specialized in teaching Qur'an memorization so that they could learn conveniently from qualified teachers.

4.3.2. Enhancing the Traditional Experience

Lessening the Barriers to Entry

For the physical Qur'an, while most participants indicated that they were satisfied with the format as-is, some participants shared that it would have been helpful if the books provided more guidance and instruction when they had begun the process of reading and memorizing the Qur'an. They said they would prefer having a guide that explains how to understand all of the symbols, diacritics, and markings in the Qur'an that they had to learn from other sources. Others said that they wanted the chapter, page, and verse names and numbers to be written in English instead of Arabic so they could navigate through the Qur'an better. Participants also said they would appreciate having thematic summaries of chapters to understand the context and relationships of the verses before memorizing them.

Interacting with the Content

Similar to feedback given for the digital devices, participants said they would benefit from being able to interact with the physical Qur'an beyond reading with it. Some shared that they wanted a designated area on the page to write reflections, translations and notes instead of writing in the narrow margins. Others said they would like physical Qur'ans to come with labels and stickers as inserts to put on pages. One female participant who wanted to avoid touching the Qur'an with her bare hands when menstruating said she would appreciate having a large bookmark to turn pages. Another participant suggested developing custom pens that can recognize words on the physical Qur'an and plays audio or translation when words are tapped.

Chapter 5: Discussion & Conclusion

5.1. Discussion

The findings from this research study contribute to the growing body of literature examining memorization, spirituality, technology, and the intersections that can be found among them. The research findings show that the tradition of scriptural memorization continues to this day in the Muslim community, even with convenient access to digital and physical formats of the scripture, and that the practices and methods of memorization continue to evolve in parallel to the growth of usage and innovation of digital tools and technologies.

The study findings corroborate with broader research being conducted on the impact of digital and physical book formats on memorization in that while earlier studies in the 1980s and 1990s showed paper-based texts to be clearly more effective than computer-based texts for reading speeds, comprehension, and memorization [25], more recent studies have given mixed results, with some findings now showing the latter to be as effective or even more so than the former [15]. The increase in effectiveness is potentially due to the growing usage of digital devices by all age groups and improvements in digital tools reducing performance differences [59]. The conclusion reached by some researchers is that both formats are beginning to yield similar results and that mixed results of comprehension and retention seem to be based on specific factors such as readers' interests, their purpose of reading, and the text length and structure [15]. This goes in line with this study's findings that while participants said their experience of memorizing on the physical Qur'an was better,

they found the digital format to be a good complement or substitute, which includes many benefits and features they would utilize again in the future. The quantitative findings of the amount of Qur'an memorized and the amount of time spent memorizing per format being similar for both formats show that the variance in measurable outcomes has already been minimized and that now it is a matter of narrowing the gap of experience-related factors of both formats.

The research conducted also contributes to studies that examine the intersection of Qur'an memorization and digital technology. While other studies focused on the quantitative differences between memorizing on digital and physical formats or mainly studied younger age groups, this study was novel in conducting qualitative research and involving participants from a broader set of ages spanning from ages 18 to 65. The research into experiential and subjective factors – such as participants' perceived levels of difficulty and connection to God and the scripture as it related to Qur'an memorization, proved to furnish significant value and contributions since it was those factors that were found to have statistically significant differences, in contrast to the objective and measurable outputs of amount memorized and time spent memorizing.

The study also shed light on an important topic that requires further research, namely the significance and impact of gender as it relates to memorizing the Qur'an in different formats. While this study was conducted with an open-ended approach seeking to understand more fundamentally if there were any general differences

between the physical and digital formats of memorizing, the statistical analysis and qualitative feedback from the diary log and interviews found there to be a difference in experiences and sentiments with the two formats between male and female participants and also uncovered that the digital formats allowed many female adherents to recite and memorize the Qur'an during all times, including when they were on their menstruation cycles, which they would not be able to do so otherwise. The findings establish the need to explore the intersection of gender and Qur'an memorization further in order to understand what factors and contexts are influencing the differences between genders. The exploration could include studying the level of usage and access to technology by gender, the degree of diversity and inclusion in the development, testing, and marketing of Qur'an and memorization tools, and even seeing if religious guidelines around utilizing digital devices for those menstruating or ritually impure will change as digital technology becomes more ubiquitous.

Lastly, the research demonstrates that the innovative tools being developed to further Qur'an memorization on digital devices are having a positive impact on memorizers and are being used to great effect. The study shows a demonstrated need for Qur'an memorization apps on digital devices that allows for learning the oral recitation and content on one's own and provides convenience and accessibility to those unable to utilize or carry the physical format. The participants' reported benefits and challenges show that more can be done to improve the digital memorization experience, and the design recommendations accordingly provide a direction forward for future enhancements.

5.2. Limitations

There were limitations with this research that are worth mentioning to contextualize and understand the limits of this study. Firstly, the participants' demographics were relatively diverse in most categories, except for race, as 74% of the participants who completed the study identified as Asian or Pacific Islander. The implication of this is that the analysis and findings should be understood to be applicable for Asians and Pacific Islanders memorizing the Qur'an and living in the United States during this point in time, and that results when looking at other races may yield different results. The study also involved many complex and multi-faceted variables, such as rating one's sense of connection to God or determining difficulty based on the memorization format when the content of the pages or background of the participants could also factor into the level of difficulty. Participants were also dealing with personal situations, such as COVID-19, illnesses and the winter storm in Texas that led to widespread outages that could have affected this study's results.

In terms of the process, while I checked my statistical analysis with professors and data analytic professionals, I could have involved other researchers in performing an in-depth check on the coding and qualitative analysis. I could have also tried to control more factors, such as specifying the exact number of days that one had to memorize with a format, the specific apps and books that participants should have memorized, and the particular passages to memorize. While I used average scoring and left those factors unrestricted to capture a variety of responses and see the preference of participants, I see the value in controlling those variables.

5.3. Conclusions & Future Research

Based on a study of twenty-three participants who completed questionnaires, a monthlong diary study and post-study interviews, the study findings demonstrate that there is a difference in the experience of using a physical and digital device for scriptural memorization in terms of perceived ease of memorization, the amount of time spent memorizing and sense of connection to God, and that there are clear benefits, challenges, and opportunities with utilizing both formats. Based on participant feedback, the study concludes with recommending design enhancements to improve the user experience of memorizing the Qur'an for both the physical and digital formats.

This study provides a foundation for future research to understand further the reasons and contexts behind some of the differences reported in the findings. Future studies can explore segmentation across more demographics and categories, including race, age, reading fluency, tech fluency, and proficiency levels of reading and understanding Arabic. In terms of accessibility, there is much to explore to understand how the digital and physical methods of memorization are experienced by participants with physical or mental disabilities and impairments. More participants can be included in future studies, and more factors can be controlled to run statistically significant quantitative tests and analyses of specific demographics and categories of participants. Future studies can also include action research to empirically test and identify new features for a better memorization experience and explore the effects of memorizing the Qur'an with both formats simultaneously.

Chapter 6: Appendices

6.1. Recruitment Materials

Ad Flyer Graphic

Team #Digital or #Physical?

How do you memorize Qur'an best?

Call for Study Participants!

For a Master's thesis project at the University of Maryland, we're looking for Muslim youth and adults in the US to join a **monthlong study in memorizing Qur'an** using only a physical Qur'an for 2 weeks and only a digital device for 2 weeks

Participants will be asked to:

- 1. Memorize Qur'an** for at least 30 minutes a day for 5 days a week over 1 month (20 days total), using a physical Qur'an for 2 weeks and a digital device (e.g., phone, tablet) for 2 weeks
- 2. Record their experience** in a daily diary log
- 3. Attend a post-study remote interview** to discuss their experience during the study

More Details:

- **Compensation:** \$50 Upon Study Completion
- **Study Period:** February 1 to February 28, 2021
- **Location:** 100% Remote (Interviews over Zoom)
- **Eligibility:** Muslim, US Resident, Age 18 or Older

Interested? Sign up at arifkabar.com/quran
Researcher: Arif Kabir (akabir@umd.edu or 240-338-7581)

Ad Flyer Text

Team #Digital or #Physical?

How do you memorize Qur'an best?

Call for Study Participants

For a Master's thesis project at the University of Maryland, we're looking for Muslim youth and adults in the US to join a **monthlong study in memorizing Qur'an** using only a physical Qur'an for 2 weeks and only a digital device for 2 weeks

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- **Eligibility:** Muslim, US Resident, Age 18 or Older

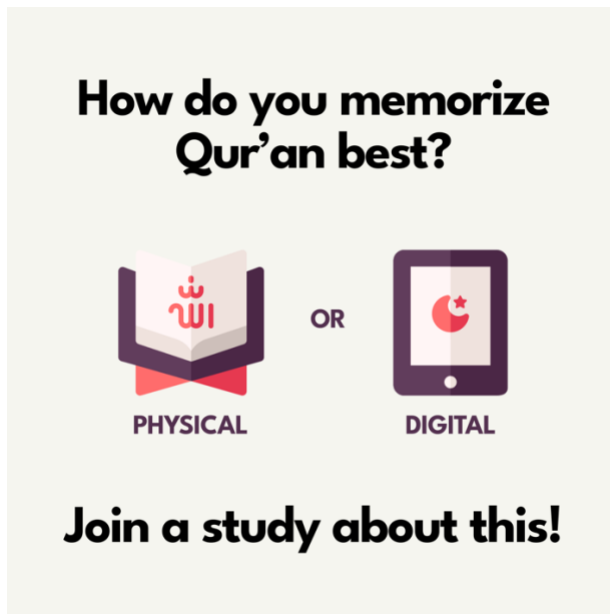
Interested? Sign up at arifkabar.com/quran

Facebook and Instagram Ad Text

Text in image: How do you memorize Qur'an best? Physical or Digital?

Join a study about this!

Text in caption: Do you memorize Qur'an? Join a paid 30-day research study about Qur'an memorization! 2 weeks physical, 2 weeks digital: <http://arifkabar.com/quran>



Twitter Ad Text

Text in tweet: Call for Research Participants! I'm conducting a study for my Master's where participants will memorize Qur'an for 2 weeks using a physical Qur'an and 2 weeks using a digital device. Participants will get \$50 at the end of the study. Interested? Sign up at arifkabar.com/quran!

Text in image: How do you memorize Qur'an best? Physical or Digital?

Join a study about this!

Letter to School Administrators

Note: “Assalamu alaikum” is Arabic for “Peace be upon you”.

“Insha’Allah” means “God Willing”.

“Jazakum Allahu Khairan” means “May God bless you with goodness”.

Email Subject: Qur’an Study: Student Participants Requested

Email Body:

Assalamu alaikum,

I pray this finds you well.

My name is Arif Kabir, and I am a graduate student at the University of Maryland, College Park. I am contacting you in regard to a study I am conducting for my master’s thesis in Human Computer Interaction related to Qur’an memorization, and am requesting if you could let students at your program know about this study? I am looking to secure 15 participants so your efforts will be very much appreciated and will help us to learn more about any digital impacts on Qur’an memorization insha’Allah. Below is more information about the study for your reference. I have also attached a flyer with the same information.

Study Objective: Research the experiences of Muslim students memorizing the Qur’an and see whether their quality of memorization or level of spiritual connection to Allah and the Qur’an is affected when using a physical Qur’an or a digital device (e.g., smartphone, tablet with a Qur’an app).

The study will ask participants to:

1. Memorize Qur'an for at least 30 minutes for 5 days a week over 1 month (20 days total) using a physical Qur'an for 2 weeks and a digital device for 2 weeks
2. Record their experience in a daily diary log
3. Attend a post-study remote interview to discuss their experience during the study

The study will run from February 1 to February 28, 2021. Everything will be conducted remotely over Zoom, and participants will receive \$50 upon study completion. The eligibility to be a research participant is to be Muslim, 18 years or older, and residing in the United States.

If you are interested in the study, please visit ArifKabir.com/Quran to fill out the participant study interest questionnaire!

Please let me know if you can forward this to your school community and if you have any questions or concerns. Jazakum Allahu Khairan!

Sincerely,

Arif Kabir

Qur'an Memorization Study

Team #Digital or #Physical?

How do YOU memorize Qur'an best?

Table Of Contents ▾

- [Study Information](#)
- [Participant Interest Questionnaire](#)

Study Information

Objective: For a Master's thesis project at the University of Maryland, we're looking for Muslim youth and adults in the US to join a study to see whether their quality of memorization or level of spiritual connection to Allah and the Qur'an is affected when using a physical Qur'an or a digital device (e.g., smartphone, tablet with a Qur'an app).

Participants will be asked to:

- Memorize Qur'an for at least 30 minutes for 5 days a week over 1 month (20 days total) using a physical Qur'an for 2 weeks and a digital device for 2 weeks
- Record their experience in a daily diary log
- Attend a post-study remote interview to discuss their experience during the study

Logistics:

- The study will run from February 1 to February 28, 2021
- Everything will be conducted remotely over Zoom
- Participants will receive \$50 upon study completion
- The eligibility to be a research participant is to be Muslim, 18 years or older, and residing in the United States

The infographic is titled "Team #Digital or #Physical? How do you memorize Qur'an best?". It features a header with the title and a call to action: "Call for Study Participants! For a Master's thesis project at the University of Maryland, we're looking for Muslim youth and adults in the US to join a monthlong study in memorizing Qur'an using only a physical Qur'an for 2 weeks and only a digital device for 2 weeks." Below this, it lists the tasks for participants: "1. Memorize Qur'an for at least 30 minutes a day for 5 days a week over 1 month (20 days total) using a physical Qur'an for 2 weeks and a digital device for 2 weeks." and "2. Record their experience in a daily diary log." and "3. Attend a post-study remote interview to discuss their experience during the study." At the bottom, it provides "More Details": "• Compensation: \$50 Upon Study Completion", "• Study Period: February 1 to February 28, 2021", "• Location: 100% Remote (Interview over Zoom)", "• Eligibility: Muslim, US Resident, Age 18 or Older". It also includes a sign-up link: "Interested? Sign up at [arifkabi.com/quran](#)" and the researcher's name and contact info: "Researcher: Arif Kabir (akabir@umd.edu or 240.338.7581)".

Participant Interest Questionnaire



The interest questionnaire is now closed.

Due to the overwhelming interest in this research study, the questionnaire is now closed. For the 75+ people who have submitted a questionnaire, thank you, and I will be in touch with you soon. For those of you who were interested but were not able to fill this questionnaire out, may Allah bless your intentions!

If you have any questions about the study or want to be notified once it has been completed in mid-2021, please let me know.

Contact

6.2. Consent Form



Initials: _____ Date: _____

Institutional Review Board

1204 Marie Mount Hall • 7814 Regents Drive • College Park, MD 20742 • 301-405-4212 • irb@umd.edu

CONSENT TO PARTICIPATE

Project Title	<i>Memorizing the Sacred in the Digital Age</i>
Purpose of the Study	<i>This research is being conducted by Arif Kabir at the University of Maryland, College Park. We are inviting you to participate in this research project because you have qualified for the study by expressing interest in being a part of the research project and identifying as someone who is actively reading and memorizing the Qur'an. The purpose of this research project is to conduct a phenomenological study examining the experiences of Muslims who have been memorizing the Qur'an using either traditional or digital methods, and to see how that experience - whether it be their quality of memorization or emotional connection to the scripture - would change when using another type of method.</i>
Procedures	<p><i>The procedures are estimated to take a total time commitment of 12 hours per participant and involve:</i></p> <p><i>1) A pre-survey questionnaire collecting information about you and your Qur'an memorizing experience (est. time: 10 minutes)</i></p> <p><i>2) Memorizing Qur'an for 30 minutes on 20 unique days during the study period between February 1 to February 28, 2021 (est. time: 10 hours total)</i></p> <p><i>3) A daily diary entry to be logged every day you memorize Qur'an during the study period (est. time: 3 min daily x 20 times = 1 hour total). The diary entries have to be submitted daily at least 20 times between February 1 to February 28, 2021. The questions will ask if you have memorized that day, and if so in which format, how many lines, for how long, a scale of how easy it was for you, and anything else you would like to add.</i></p>

	<p>4) A post-study follow-up interview (est. time: 1 hour). The questions will include asking about your experience, what impacts it had on your memorization and spirituality, if it felt different using the digital and physical formats, etc.</p> <p>The study will be entirely remote and conducted over Zoom. At the end of the study, you will receive a \$50 monetary compensation for your time if you complete the study and post-study interview.</p>
Potential Risks and Discomforts	<p>There are no risks foreseen for participating in this research study. All research will be conducted remotely.</p>
Potential Benefits	<p>You will have the opportunity to examine the difference between reading the Qur'an virtually and physically. We hope that, in the future, other people might benefit from this study through improved understanding of the intersection of technology, spirituality, and memory.</p>
Confidentiality	<p>Any potential loss of confidentiality will be minimized by storing data in a secure location such as a password-protected computer. The data will be retained only for the duration of the study and analysis period and will be deleted by June 1, 2021.</p> <p>For any reports or articles about this research project, including the Master's Thesis report, your identity will be protected to the maximum extent possible. The data will be anonymized in the report by removing any mention of your name. The researchers will aggregate data and when needed, will include quotes from you in the report without any identifiable personal information included. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.</p>
Compensation	<p>You will receive \$50 upon successful completion of the study. You will be responsible for any taxes assessed on the compensation.</p> <p>Since you will not be earning more than \$100, only your name and address will be collected to receive compensation.</p>
Right to Withdraw and Questions	<p>Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop</p>

	<p><i>participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.</i></p> <p><i>If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:</i></p> <p style="text-align: center;">Arif Kabir 6100 Westchester Park Dr. #501 College Park, MD 20740 akabir@umd.edu</p>	
<p>Participant Rights</p>	<p><i>If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:</i></p> <p style="text-align: center;">University of Maryland College Park Institutional Review Board Office 1204 Marie Mount Hall College Park, Maryland, 20742 E-mail: irb@umd.edu Telephone: 301-405-0678</p> <p><i>For more information regarding participant rights, please visit: https://research.umd.edu/irb-research-participants</i></p> <p><i>This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</i></p>	
<p>Statement of Consent</p>	<p><i>Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.</i></p> <p><i>If you agree to participate, please sign your name below.</i></p>	
<p>Signature and Date</p>	<p>SIGNATURE OF PARTICIPANT</p>	
	<p>NAME OF PARTICIPANT</p>	
	<p>DATE</p>	

6.3. Study Interest Questionnaire

Contact Information

Please provide this information so that we can contact you about the study.

1. Name (Open-Ended Text Question)
2. Email (Open-Ended Text Question)
3. Phone Number (Open-Ended Text Question)

Demographics

This information will help us to select a diverse set of participants and will enable us to compare responses among demographic groups.

4. Gender (Open-Ended Text Question)
5. Race
 - a. Asian or Pacific Islander
 - b. Black or African American
 - c. Hispanic or Latino
 - d. Native American or Alaskan Native
 - e. White or Caucasian
 - f. Multiracial or Biracial
 - g. A race/ethnicity not listed here
 - h. I prefer not to answer
6. Age
 - a. 18-24 years old
 - b. 25-34 years old

- c. 35-44 years old
- d. 45-54 years old
- e. 55-64 years old
- f. 65-74 years old
- g. 75 years or older
- h. I prefer not to answer

7. Employment Status

- a. Employed full-time (40 or more hours per week)
- b. Employed part-time (up to 39 hours per week)
- c. Unemployed and currently looking for work
- d. Unemployed and not currently looking for work
- e. Student
- f. Retired
- g. Homemaker
- h. Self-employed
- i. Unable to work
- j. I prefer not to answer

8. How many pages of the Qur'an have you memorized? (Open-Ended Text Question Accepting Numeric Responses)

9. What format do you typically read and memorize the Qur'an in?

- a. Always on a physical Qur'an
- b. Mostly on a physical Qur'an, sometimes on a digital device
- c. Half of the time on a physical Qur'an, Half on a digital device

- d. Mostly on a digital device, sometimes on a physical Qur'an
- e. Always on a digital device

Eligibility Requirements

10. Please confirm you meet all of the requirements for this study by selecting all of the checkboxes:

- I am a Muslim, 18 years old or above, living in the United States
- If selected, I will memorize the Qur'an for at least 30 minutes a day for five days a week for four weeks (20 sessions total) between February 1-February 28, 2021
- If selected, I will read and memorize using only a physical Qur'an for two weeks and read and memorize using only a digital device for two weeks. I will have access to a physical Qur'an and a digital device with a Qur'an app (e.g., [iOS app](#) or [Android app](#)) to use for this study.
- If selected, I will complete a short diary log every day I memorize Qur'an during the study (less than 5 minutes to fill out) to share my experiences
- If selected, I will fill out a consent form and a pre-study questionnaire and can attend a follow-up interview after the study to discuss my experience
- I understand that I will only receive the \$50 monetary compensation if I complete the entire study and follow-up interview
- I consent to receiving research-related communications on my email and/or phone, which can include links to forms and reminders to fill out the diary log

6.4. Pre-Study Questionnaire

Congratulations! You have been selected for the Qur'an Format Study and we are looking forward to seeing how your experiences are during this time. To assist us in our research, capture additional demographic information, and help us understand how your experiences may be different from other participants, please sign the consent form sent via email and fill out the following questionnaire by February 1, 2021. All of the information you enter is confidential and will be anonymized and summarized in the final thesis report.

1. What is your name?
2. What sect of Islam do you identify with?
 - a. Sunni
 - b. Shia
 - c. Other:
 - d. I prefer not to answer
3. How did you come to be a Muslim?
 - a. Converted to Islam
 - b. Born into a Muslim family
 - c. Left Islam/Muslim community, came back
 - d. Other:
 - e. I prefer not to answer
4. How would you rate your connection to God?

0 = No connection at all; 10 = Very strong connection

- a. 0-10 scale
5. How would you identify your Arabic language reading proficiency?
- a. Beginner
 - b. Intermediate
 - c. Advanced
 - d. Native
 - e. I prefer not to answer
6. How would you identify your Arabic language speaking proficiency?
- a. Beginner
 - b. Intermediate
 - c. Advanced
 - d. Native
 - e. I prefer not to answer
7. How often do you read the Qur'an currently?
- a. Daily
 - b. 2-3 times a week
 - c. Once a week
 - d. Once every two weeks
 - e. Once every month
 - f. Other:
 - g. I prefer not to answer
8. How often do you memorize the Qur'an currently?
- a. Daily

- b. 2-3 times a week
- c. Once a week
- d. Once every two weeks
- e. Once every month
- f. Other:
- g. I prefer not to answer

9. How many pages of the Qur'an do you usually memorize per month?

- a. Up to 1/2 a page
- b. 1/2 page to 1 page
- c. 1 to 5 pages
- d. 5 to 10 pages
- e. 10 to 20 pages
- f. 20 pages or more
- g. I prefer not to answer

10. With whom do you memorize? Check all that apply.

- a. I memorize with a teacher
- b. I memorize with family
- c. I memorize with a peer
- d. I memorize by myself
- e. Other:

11. How many years have you been involved in memorizing the Qur'an?

12. Is there anything else about yourself you would like to add?

6.5. Daily Diary Form

For every day you read and memorize Qur'an, please fill out this questionnaire.

1. Name
2. Date
3. Did you memorize today?
 - a. Yes
 - b. No
4. What format did you memorize in?
 - a. Physical Qur'an
 - b. Digital Device
5. How many lines did you memorize today?
6. How long did you memorize for?
 - a. 0-29 minutes
 - b. 30-59 minutes
 - c. 1-2 hours
 - d. More than 2 hours
7. On a scale of 1-10, how difficult was it to memorize today?
0 = Very Easy, 10 = Very Difficult
8. Please add 1-2 sentences of details from your memorization experience today.
(e.g., your mood, your environment, what chapter you memorized, techniques you used to memorize, if you faced any distractions, any reflections etc.)

6.6. Post-Study Interview Questions

1. How was your experience?
2. Was the experience of your participation what you were expecting in using both formats? Any surprises?
3. Did you memorize using any new or different techniques during this time?
E.g., digital device, using audio, using translations, etc.?
4. Were there times you felt distracted? E.g., notifications, urges to check other apps, urges to stop. If so, how?
5. Were there times you wanted to give up? Did you ever give up, either on purpose or by accident?
6. On a scale of 0-10, how would you rate your connection to God now? (0 = No connection at all; 10 = Very strong connection)
7. Did you feel closer to God with one method over another?
8. How would you rate your memorization experience with a physical Qur'an and with a digital device?
 - a. Physical Qur'an: (1) Strongly Dislike; (2) Dislike; (3) Neutral; (4) Like; (5) Strongly Like
 - b. Digital Qur'an: (1) Strongly Dislike; (2) Dislike; (3) Neutral; (4) Like; (5) Strongly Like
9. Did you ever feel guilty when you were forced to only use one method?
E.g., not being able to get blessings from the physical book
10. Were there times you wanted to read but could not do so due to the format?
E.g., not having a physical device or digital device at hand

11. Did your short-term or long-term retention feel stronger or weaker with a specific method? If so, how?
12. Do you believe one method of memorization gives you more blessings?
13. Will you be changing anything on how you memorize after this study?
14. If you did this study again, would you do anything differently?
15. Following your experience, how would you recommend someone else memorizes?
16. Do you have recommendations on how the physical or digital formats could be improved?
17. Let's review your report. What are your thoughts after reviewing the metrics?
18. Was there anything else you wanted to cover?

6.7. Key Communications to Participants

Communication: Participant has been selected (1/20/21)

Note: Students will be asked to begin memorizing with the opposite format to what they typically memorize with (determined by Q9 on the Participant Study Interest Questionnaire (see Appendix 0). If they selected “Half of the time on a physical Qur’an, Half on a digital device”, then they will be given a random selection.

Email Subject: Qur’an Study: You have been Selected!

Email Body:

Assalamu alaikum,

Thank you for filling out the Participant Interest Survey Questionnaire for the [Qur’an Memorization Study](#). I am happy to inform you that you have been selected for the study, which will take place from February 1 to February 28, 2021.

Action Required Now:

Prior to the study beginning on February 1, 2021:

1. Please sign the attached Consent Form (see Appendix 6.2 for details) and send it back via email.
2. Please fill out this Thesis Pre-Study Questionnaire (see Appendix 6.4 for details), which will help us understand more about your profile and experience. All of the information you enter is confidential and will be anonymized and summarized in the final thesis report.

Next Steps:

Insha'Allah, I will be contacting you again on February 1, 2021 that the study has begun. Here are some initial details about the study for your reference:

Study Details

- For this study, you will memorize using a [physical Qur'an OR digital device (e.g., smartphone or tablet with a Qur'an app)] for the first two weeks of February 2021 and then a [physical Qur'an OR digital device (e.g., smartphone or tablet with a Qur'an app)] for the next two weeks.
- For every day you memorize in February 2021, please record your response here [link to diary form].
- Please submit 5 responses per week (20 total for the study). Each response should only take around 3 minutes of your time

I look forward to your participation in the study! Please let me know if you have any questions or concerns. Jazakum Allahu Khairan.

Sincerely,

Arif Kabir

Communication: Participant has not filled Study Prerequisite Forms (1/27/21)

Note: This will only be sent to participants who have not filled out the Pre-Study Questionnaire and Consent Form by 1/27/21 12pm ET.

Email Subject: Reminder: Fill out Pre-Study Questionnaire and Consent Form

Email Body:

Assalamu alaikum,

This is a friendly reminder to please sign the attached Consent Form (see Appendix 6.2 for details) and fill out the Thesis Pre-Study Questionnaire (see Appendix 6.4 for details) for the Qur'an Memorization Study by February 1! The questionnaire responses will help us understand more about your profile and experience. All of the information you enter is confidential and will be anonymized and summarized in the final thesis report.

I look forward to your participation in the study! Please let me know if you have any questions or concerns. Jazakum Allahu Khairan.

Sincerely,

Arif Kabir

Communication: Study Beginning (2/1/21)

Email Subject: Qur'an Study Begins Today! Instructions & Details

Email Body:

Assalamu alaikum,

Today begins the Qur'an Memorization Study where you'll be recording your Qur'an memorization experiences for the month of February! Please read through the study details carefully. I look forward to your first diary response today!

Study Details

- For this study, you will memorize using a [physical Qur'an OR digital device (e.g., smartphone or tablet with a Qur'an app)] for the first two weeks of

February 2021 and then a [physical Qur'an OR digital device (e.g., smartphone or tablet with a Qur'an app)] for the next two weeks.

- For every day you memorize in February 2021, please record your response here [link to diary form].
- Please submit 5 responses per week (20 total for the study). Each response should only take around 3 minutes of your time

Reminders

Since this is a monthlong study and it's possible you might not remember submitting a diary entry on days you memorize (we're all busy humans after all!), I will send you a reminder text message no more than 3 times a week on Wednesdays, Fridays, and Sundays if you haven't already submitted 5 entries for that week and haven't submitted something by 8pm that day. The text message will be sent to the phone number you provided us and will say, "Friendly reminder to please submit your Qur'an diary today! [link to diary form]."

Note: If you wish to receive zero reminders, less reminders, or more reminders than the 3x a week I mentioned above or prefer receiving emails reminders instead of text messages, please let me know! You can opt out or change your preferences any time you like. Please let me know if you have any questions. Jazakum Allahu Khairan.

Sincerely,

Arif Kabir

Communication: Participant Memorized in Wrong Format (Any Day)

Note: If the participant filled out their diary study and indicated in their response on Question 4 that they memorized in a different format than they were told to, they will receive this communication.

Email Subject: Your Memorization Format

Email Body:

Assalamu alaikum,

While I was reviewing your diary responses from yesterday, I noticed that you said you memorized using a [physical Qur'an OR digital device]. However, the instructions are for you to memorize using a [physical Qur'an OR digital device] until [February 14, 2021 OR February 28, 2021]. Please memorize using a [physical Qur'an OR digital device] until then.

Let me know if you have any questions. Jazakum Allahu Khairan.

Sincerely,

Arif Kabir

Communication: Reminder Text or Email Message (Any Day)

Note: The default will be sending text messages but could be different if the participant requests a different cadence or format for receiving reminders.

Text message: "Friendly reminder to please submit your Qur'an diary today! [link to diary study form]"

Communication: Study Halfway Done (2/15/21)

Email Subject: Qur'an Study Halfway Done! Time to Change Format

Email Body:

Assalamu alaikum,

Believe it or not, the Qur'an Memorization study for February 2021 is halfway complete and we only have two weeks left! A big thank you for sticking to the program – it means a lot to me and it will help many Muslims who are deciding how to memorize and come across this study. As we have crossed the halfway point, it's time to now change your format and memorize using a [physical Qur'an OR digital device] until February 28, 2021. Please let me know if you have any questions.

Sincerely,

Arif Kabir

Communication: Motivation to Continue Study (2/21/21)

Note: Messages like these were sent weekly to help motivate participants.

Email Subject: Qur'an Study – 7 Days to Go!

Email Body:

Assalamu alaikum,

Jazakumullahu khayran for sticking with the Qur'an Study program. I've enjoyed reading your daily experiences and reflections, including how the format change this past week has been for you. Together, you have collectively submitted 365 entries masha'Allah - it's as if one person memorized every day for a year!

Believe it or not, there are only seven days to go in February and in the program. I pray Allah helps you to finish strong in the program. As we start to wrap, here are a couple of important notices:

1. Please submit all 20 entries before the program ends on February 28, 2021 at midnight (thank you to those who completed all 20 already!). I need all 20 entries to count you towards the program's guidelines for completion and compensation.
2. Once you have submitted 18 entries, I will invite you this week to schedule the post-study interview. The interview will take around 30 minutes and the intention is to conduct all interviews between March 1-March 10, 2021.

Best,

Arif Kabir

Communication: Study Complete. Post-Study Instructions (2/28/21)

Email Subject: Qur'an Study Done! Post-Study Interview

Email Body:

Assalamu alaikum,

Congratulations! You have completed the Qur'an memorization study! We just have one post-study left and then you'll be all done and will have the \$50 compensation sent to you too. Please let me know what days and times you are available between now and March 10, 2021 for a post-study interview (est. time 1 hour).

Sincerely,

Arif Kabir

6.8. Diary Reminder Cadence

Participants were sent reminders to fill out their diary if they met these conditions:

	Wednesday	Friday	Sunday
Week 1	2/3/21	2/5/21	2/7/21
	Contact if (1) Participant hasn't submitted today yet and (2) it's past 8pm	Contact if (1) Participant hasn't submitted yet and (2) it's past 8pm	Contact if (1) Participant hasn't submitted 5 entries in the week, (2) hasn't submitted today yet and (3) it's past 8pm
Week 2	2/10/21	2/12/21	2/14/21
	Contact if (1) Participant hasn't submitted today yet and (2) it's past 8pm	Contact if (1) Participant hasn't submitted yet and (2) it's past 8pm	Contact if (1) Participant hasn't submitted 5 entries in the week, (2) hasn't submitted today yet and (3) it's past 8pm
Week 3	2/17/21	2/19/21	2/21/21
	Contact if (1) Participant hasn't submitted today yet and (2) it's past 8pm	Contact if (1) Participant hasn't submitted yet and (2) it's past 8pm	Contact if (1) Participant hasn't submitted 5 entries in the week, (2) hasn't submitted today yet and (3) it's past 8pm
Week 4	2/24/21	2/26/21	2/28/21
	Contact if (1) Participant hasn't submitted today yet and (2) it's past 8pm	Contact if (1) Participant hasn't submitted 10 entries of the second format already, (2) hasn't submitted today yet and (3) it's past 8pm	Contact if (1) Participant hasn't submitted 10 entries of the second format already, (2) hasn't submitted today yet and (3) it's past 8pm

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